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Spreading the Demand

One-third Reduction Aimed At

LOAD-SHEDDING last year was a nuisance; early this year it was becoming something worse, but its serious possibilities were obscured by the fuel crisis. Next winter there will be, according to official estimates, an appreciably greater discrepancy between the generating plant capacity and the maximum demand, which is expected to be 70 per cent above the 1939 figure even though the load factor is much higher. The statement by the Minister of Labour that wholesale load-shedding would gravely prejudice national recovery is certainly no exaggeration. Unless action is taken within the next few weeks to counter the effects of plant deficiency, the gravity of the situation is, in our view, likely to rank with that due to coal shortage.

General Scheme Unfeasible

The Ministerial decision to take steps to reduce the demand by one-third through the staggering of factory hours seems the only one practicable in the circumstances. It will not be easy to implement. No general scheme appears to lend itself to all areas, and procedure suitable for some industries could not be adapted to others, especially those in which non-stop processes are carried on. There may also be thorny questions concerning adjustment of electricity supply tariffs.

Although industry, which takes about half the output of the power stations, is primarily under consideration, nearly as much electricity will be required by domestic premises and farms (one-third) and shops and offices (one-eighth), which have as a whole a higher peak responsibility than has motive power. These should also be required to contribute to easing the position. It must be made quite clear to all concerned that the object of the alterations in working hours is to avoid overloading generating plant and not to save coal, urgent as the need for the latter will remain. It is the time of day, not the amount used, that matters in the present connection. Actually, more electricity may be used for the time being as a result of rearrangement of domestic routine and disturbance of long-established practices in travelling and working conditions.

Power Station Staffs

The effect on the electricity supply industry of spreading the work over the day may not be so obvious, since shift work has always been a feature of its organization. Although its staffs will be freed from the daily strain of standing-by ready to cut off load, they will find other causes for worry. The running of older and less efficient plant for longer hours will presumably entail increasing maintenance, especially for boilers. Moreover, present maintenance procedure has been devised to fit in with normal load curves so as to enable plant to be taken out of commission during the valleys in the demand.

The very great variation in conditions that exists between different localities implies that the practical details will be worked out regionally between the Central Electricity Board and the supply undertakings. On this, the production,

side the electricity supply industry can be counted on to do its share and a bit more. If a similar spirit is evident among the users of electricity, there will be no need for penalties.

Progress of Electricity Bill

LESS than three days sufficed to complete the Committee stage of the Electricity Bill in the House of Lords. Unlike the measure for the nationalization of transport, its passage was comparatively smooth. One amendment carried against the Government, which was moved by Viscount Swinton, seeks to set up an appeal tribunal to approve maximum tariffs and hear representations. The Lord Chancellor resisted the amendment, which he contended would duplicate the work of the Consultative Councils. The House was not satisfied that these Councils would provide an effective safeguard to consumers and by twenty-eight votes to seventeen the new clause was approved.

Manufacturing Powers

ONE of the most controversial sections of the Bill —the powers given to the British Electricity Authority to manufacture electrical plant and fittings—was debated at length, but finally an amendment for its omission, also moved by Viscount Swinton, was withdrawn. It was stated, as in the Commons, that the Government did not anticipate using the powers except as a "weapon of defence," but the Lord Chancellor's assurance on the point was qualified by "so far as one could perceive, at any rate for the next few years."

Power Station Efficiencies

A FEATURE of the Electricity Commissioners' Fuel Returns for 1946, reviewed in this issue, is the good showing of the power stations which first came into operation during and since the war. Hams Hall "B," Llynfi, Earley, Castle Meads, Littlebrook and Mexborough all achieved overall thermal efficiencies in excess of 24 per cent, the first two being better than 26 per cent. Especially notable was the performance of Hams Hall "B," a cooling-tower station with steam conditions of 650 lb per sq. in. and 825 deg F (with four-stage feed heating) and equipped with 50,000-kW, 1,500-r.p.m. sets. The achievement of so high a thermal efficiency as 26·79 per cent in spite of the relatively high average coal consumption of 1·4 lb per kWh sent out indicates coal of a lower calorific value than most stations have to contend with.

Fuel Quality

IN spite of the economy of the new stations, the overall consumption of coal per kWh sent out increased from 1·45 lb in 1938 to 1·52 lb last year, illustrating the effects of the deteriorating quality of coal. In 1938 an increase of 6·7 per cent over the previous year in kWh generated in the whole country was accompanied by an increase of only 1·1 per cent in the tonnage of coal, costing 20s. 3d. per ton delivered to site. That trend has now been reversed, as last year to generate 10·6 per cent more kWh than in 1945 required 11·7 per cent more coal, costing 45s. 3d.

Financing Research

ALTHOUGH the new Electricity Bill provides for a continuation of research, a couple of years or so may elapse before the Area Boards get down to the allocation of funds. In the meantime the Electrical Research Association must rely largely upon the financial support of the various supply undertakings as long as they retain their identities. Moreover, the Department of Scientific and Industrial Research helps those who help themselves. Apart from this aspect, however, there are the expenses to be incurred in the very desirable extended activities at Leatherhead, which replaces the overcrowded Perivale laboratories. Undertakings, whether municipal or company, may lawfully allocate such sums for research as may be approved by the Electricity Commissioners, who will, no doubt, be found sympathetic.

A Revival

BY arranging a week-end visit to Yorkshire on September 13th and 14th, the I.E.E. Transmission Section takes up the threads of a project that was initiated before the war relegated to limbo most opportunities of studying developments in such progressive areas as that of the Yorkshire Electric Power Co., which with the Central Electricity Board will act as host. The time that has elapsed is not altogether lost, since in the intervening eight years new technical features have been introduced that will enhance the value of the projected visits.

Phase Conversion

Deriving Three Phases from Two Lines and Neutral of Converted D.C. Network

By D. B. Corbyn,
B.Sc.(Eng.), A.M.I.E.E.

THREE-PHASE energy is sometimes required where supply is given from some other system, usually for small factories in residential areas or for farms. Where only single-phase mains are laid, either the simple pilot-motor scheme, its improvement due to the British Thomson-Houston Co. or the Westinghouse static-phase-conversion scheme is adequate. If the supply is two-phase, a Scott-connected transformer group or a Le Blanc connected transformer is available, the former usually in Britain and the latter on the Continent.

Where an old d.c. network has been adapted, two phases and neutral of a normal three-phase system are often found, presenting the advantage that lighting loads at 240-V and single-phase power loads at 415-V can both be supplied without transformation.

For phase conversion using two single-phase transformers, either auto- or double-wound, a tee connection can be employed

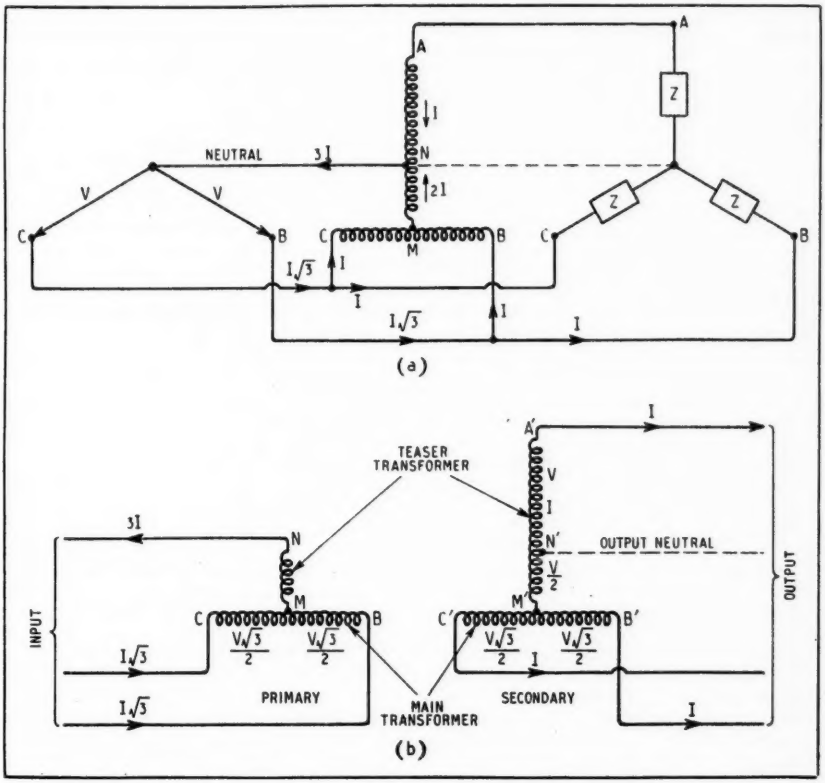


Fig. 1.—Tee connection with two single-phase transformers (unity ratio) (a) Auto-wound; (b) Double-wound

(Fig. 1)—the tappings being similar to those used for the normal three-phase tee connection. Frame sizes and comparative costs are given in Table 1 for a total three-phase

Table 1.—Tee Connection

Transformer	Transformer rating, VA	
	Double-wound, any ratio	Auto-wound, 1:1 ratio
MAIN .. .. TEASER ..	0·79 P. 0·50 P.	0·29 P. 0·33 P.
Total	1·29 P.	0·62 P.

output of "P" VA. Frame sizes are those necessary at the normal double-wound rating and comparative costs are based on equal copper and iron costs for the frames.

Frame sizes in the table are for non-interchangeable transformers not designed for later inclusion in a normal three-phase group. Primary and secondary neutral points are available but are not generally co-incident. Power-factor in the windings affects regulation and details are given in Table 2 for a balanced three-phase load having an angle of lag = θ. The zero power

Table 2.—Power Factor Details

Winding	Power factor. Current leads or lags relative to voltage
	Double-wound transformer group
MC & MC′	Leads by 30 deg $-\theta$
MB & MB′	Lags by 30 deg $+\theta$
NM	Lags by θ
A′ M′	Lags by θ
	Auto-wound transformer group
MC	Leads by 90 deg $-\theta$
MB	Lags by 90 deg $+\theta$
NM	Lags by θ
AN	Lags by θ

factor in certain windings underlines the importance of winding the transformers for minimum leakage reactance.

Incomplete Star Connection

A second method of phase conversion is by means of one three-phase three-limb core-type transformer either double- or auto-wound, termed incomplete star connection.

In the double-wound case, the secondary can be either star- or delta-connected. Frame sizes and relative costs in terms of the output VA of "P" are given in Table 3, in which the use of a standard three-phase core is assumed. Frame sizes and costs are, as before, given in terms of a normal double-wound transformer, iron and copper costs being equal.

Non-interchangeable transformers are those in which primary phase A (Fig. 2) in the double-wound case is omitted. Interchangeable transformers are those in which primary phase A in the double-wound case is provided (although not used), so that the transformer can later be used on a normal three-phase supply. An auto-connection has the great advantage that input and output neutral points are co-incident for all ratios of transformation.

Comparison with Other Schemes

For the partial three-phase supply, a normal single/three-phase conversion scheme could be employed by using two lines to feed the phase convertors. The special connections considered above have the following advantages: Lower first cost than other schemes and less maintenance than the Ferraris-Arno scheme with its rotating machines; availability of neutral points on both input and output sides, although not necessarily co-incident; overload capacity as high as that of any normal transformer (both Ferraris-Arno and Westinghouse schemes suffering from a poor regulation on overload); small no-load losses and magnetizing currents; no distortion of voltage or current waveforms.

On the other hand, output voltage is slightly unbalanced because of the internal power factors, but this unbalance is unlikely to be anything like so bad as that obtained with the other schemes mentioned; input neutral current is high, $\sqrt{3}$ times the line current; input VA is higher than output VA owing to internal power factors.

In the tee connection, the main transformer should have the two halves of the winding interlaced as tightly as possible to decrease leakage reactance. The teaser transformer should have the winding sections NM and NA interlaced for the same reasons. In all other respects the construction is normal. The main transformer has no choking effect, since the two halves of the winding carry opposing load currents. For the incomplete star connection, all the secondaries should be wound as the inner coils, in order that their internal impedances shall be equal;

Table 3.—Incomplete Star Connection

Connection	Non-interchangeable		Interchangeable	
	Frame size	Cost	Frame size	Cost
Auto-wound, 1:1 ratio	0·5 P.	0·5 P.	never required	
Double-wound	1·37 P.	1·23 P.	1·37 P.	1·37 P.

apart from this, no special precautions are necessary.

By running two lines and neutral to each area and connecting them to the substation as shown in Fig. 3, a reasonably balanced load on the generators is assured. In rural districts with only a small three-phase load, a good case can be made for such a system, since lighting, heating and single-phase power can be supplied without special apparatus and a farm load including three-phase motors can also be served. In general this method will be most useful where only a small amount of three-phase load is likely to be required.

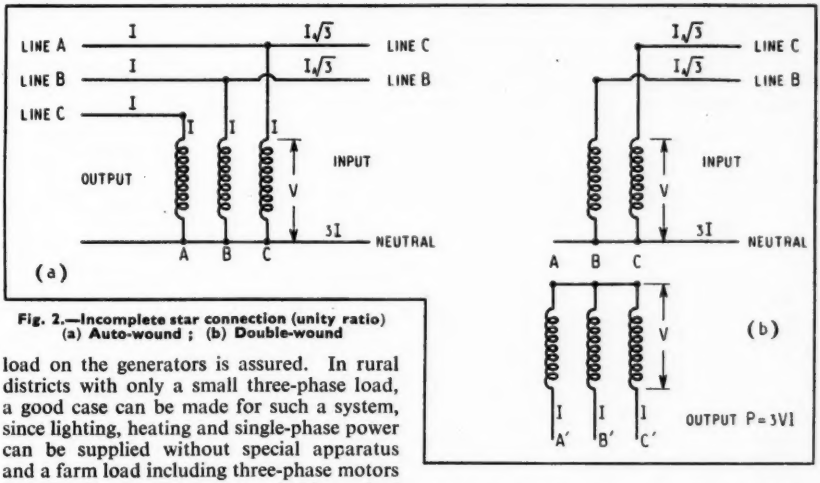


Fig. 2.—Incomplete star connection (unity ratio) (a) Auto-wound ; (b) Double-wound

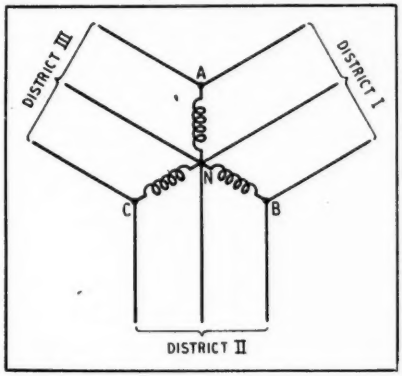


Fig. 3.—Partial three-phase distribution system

Vector Diagrams and Theory

In considering the double-wound tee connection, the two supply phases are assumed to be at V volts each; hence output is V volts per phase (from line to neutral). The vector diagram is most simply deduced by considering a pair of double-wound transformers of unity ratio, which in this case means equal input and output phase volts.

The vector diagrams in Fig. 4, show that the winding voltages are as in Fig. 1 and that, for a 1 : 1 ratio, similar points on primary and secondary can be joined without disturbing the system. Assume the secondary and load neutrals joined and consider a balanced star load with a lagging power factor of cos θ; then, from Fig. 4*a*, current in M′B′ lags 30 deg + θ on voltage of M′B′, current in M′C′ leads 30 deg − θ on voltage of M′C′, and current in N′M′ lags θ on voltage on N′M′.

The primary vector diagram is drawn by considering the various parts of the secondary loads separately. From Fig. 4*b*, the whole of the VA supplied to the secondary phase A′ returns via the secondary neutral and is supplied by primary winding NM. This current in winding NM divides equally between windings MC and MB, since the system is completely symmetrical. From Fig. 4*c*, for load phases B′ and C′, currents I'_B and I'_C are transformed directly to primary phases MB and MC. Their vector sum, flowing in winding MN on the primary side, is also I amperes lagging by θ on E_{NM}. From Fig. 4*d*, the vectors of Figs. 4*b* and 4*c* are combined to give the total primary vector diagram. Neutral current is 3I amperes, since primary teaser current must be three times secondary teaser current.

Current in MC is obtained by combining I amperes leading (30 deg — θ) with I amperes leading (90 deg — θ) to give a resultant of $1\sqrt{3}$ amps leading (60 deg — θ) on E_{MC}. The current in MB is similarly $1\sqrt{3}$ amperes lagging (60 deg + θ) on E_{MB}. These two currents returning via the neutral add up to 3I amperes.

Power input for a double-wound transformer is ascertained by the following means:

Power in phase B = $VI\sqrt{3}\cos(30 \text{ deg} + \theta)$ = $VI\sqrt{3}$ (cos 30 deg cos θ — sin 30 deg sin θ)

power in phase C = $VI\sqrt{3}\cos(30 \text{ deg} - \theta)$ = $VI\sqrt{3}$ (cos 30 deg cos θ + sin 30 deg sin θ);

total power = $2VI\sqrt{3}$ cos 30 deg cos θ = $2VI\sqrt{3}\,\frac{\sqrt{3}}{2}\cos\theta = 3VI\cos\theta$,

which is equal to the secondary power output, since the transformer losses have been neglected. Total VA input = $2VI\sqrt{3}$ and total VA output = 3 VI; hence input VA = 1·15 × output VA. This is unusual and arises from the peculiar power-factor conditions in the main transformer and indicates a choking effect in parallel with the load, since regulation is good.

Transformer frame sizes for double-wound group are for the teaser transformer, secondary VA = 3VI/2 = primary VA; hence

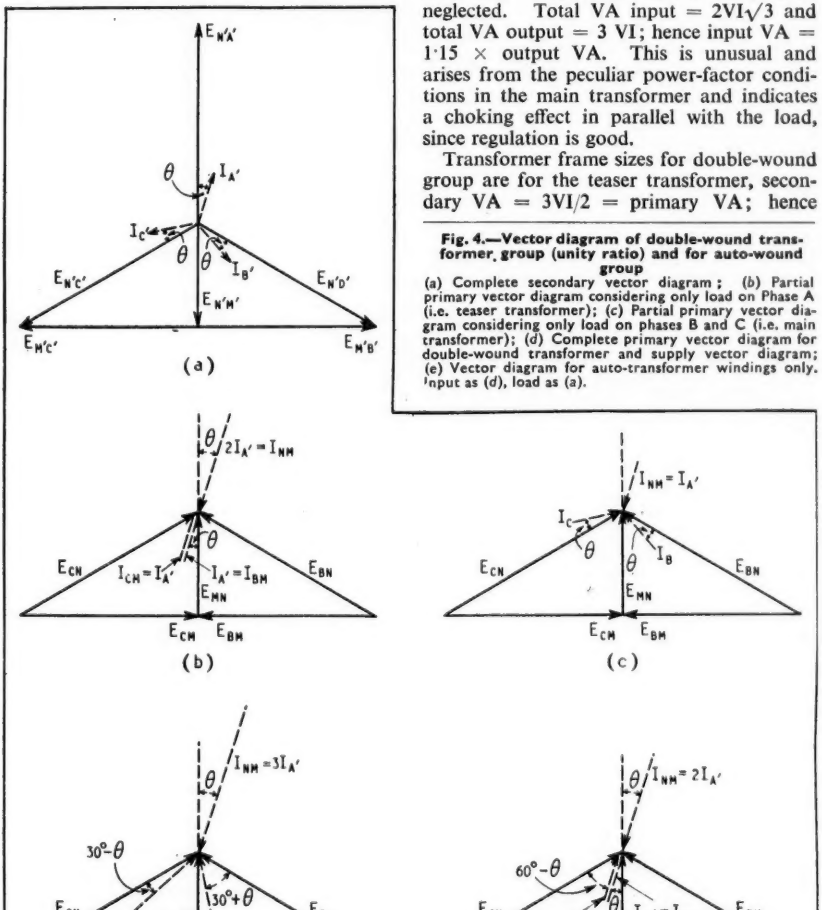


Fig. 4.—Vector diagram of double-wound transformer group (unity ratio) and for auto-wound group

(a) Complete secondary vector diagram; (b) Partial primary vector diagram considering only load on Phase A (i.e. teaser transformer); (c) Partial primary vector diagram considering only load on phases B and C (i.e. main transformer); (d) Complete primary vector diagram for double-wound transformer and supply vector diagram; (e) Vector diagram for auto-transformer windings only. Input as (d), load as (a).

frame size = 1·5 VI = 0·5 × output, since total output is 3VI. For the main transformer, VA of each secondary = $\frac{V\sqrt{3}}{2} \times I$, and VA of each primary = $\frac{V\sqrt{3}}{2} \times I\sqrt{3}$; hence sum = $\frac{VI\sqrt{3}}{2}(1 + \sqrt{3})$ and frame size = 2·36 VI = 0·787 × output. Total frame size required (i.e. the sum of separate sizes) = 1·287 × output VA.

Turning to the auto-wound tee connection, the vector diagram can be deduced by superimposing the diagrams 4*a* and 4*d* as shown in Fig. 4*e*. The currents in the two halves of the main transformers lag and lead by 90 deg on their respective voltages when supplying a unity power-factor load. Power and VA imputs are the same as in the double-wound transformer.

Transformer frame sizes for the auto-wound group are as follows:—For teaser transformer, VA of secondary N'A = VI and of secondary NM = $\frac{V}{2} \times 2I = VI$, hence frame size = 0·33 × output VA: for the main transformer, the VA of each winding = $\frac{V\sqrt{3}}{2} \times I$, and frame size = $\frac{VI\sqrt{3}}{2} = 0{\cdot}287 \times$ output VA, so that total frame size required = 0·617 × output VA.

For the incomplete star connection the required frame size can be deduced from the currents shown in Fig. 2. A standard three-phase core is assumed in which iron and copper costs are normally equal. In the case of the double-wound transformer (non-interchangeable type) from Fig. 2B, the total winding VA is 3 × VI + 2V I$\sqrt{3}$ = 6·46 VI. The core has, however, to be adequate for copper of VI$\sqrt{3}$ + VI = 2·73 VI per limb, or an iron core of size for 8·19 VI of copper. Since output is 3 VI and (in a double-wound transformer) winding VI is normally 2 × output VI. Iron weight = $\frac{8{\cdot}19}{6{\cdot}0}$ = 1·37 times normal; copper weight = $\frac{6{\cdot}46}{6{\cdot}0}$ = 1·08 times normal. Approximate cost = 1·23 times normal.

As the interchangeable type of double-wound transformer could be employed if a complete three-phase system were installed, it would frequently be worth while to provide the missing primary with the same winding as the existing primaries even though these are rather larger than necessary. Total copper weight = 3 VI$\sqrt{3}$ + 3 VI = 8·2 VI = $\frac{8{\cdot}2}{6{\cdot}0}$ = 1·37 times normal. Iron weight has already been calculated: hence total cost is 1·37 times normal. Other assumptions are possible concerning output. Thus, when acting as a normal three-phase transformer, a greater output than 3 VI is permissible, since the copper loss can be distributed equally between primary and secondary.

Auto-wound transformers (unity ratio) are shown in Fig. 2*b* to have both frame sizes and costs 0·5 times output VA. A consistent vector diagram could not be drawn for an incomplete star connection and the currents shown in Fig. 2*b*, have been obtained from experiment and by comparison with the " tee " connection.

E.I.B.A. Annual Meeting

THAT the Electrical Industries Benevolent Association had paid out in grants in the year 1946 a sum of over £16,000, which represented an increase of 33 per cent on the previous year, was stated by Mr. Walter Riggs, M.B.E., M.I.E.E., who was re-elected president of the Association at its annual general meeting held on July 24th. The income of the Association was not increasing nearly so fast, he said, and more widespread help was needed in order to balance E.I.B.A.'s budget for the future. Mr. Riggs paid tribute to the generosity of Mr. and Mrs. Joseph Cunning in giving their Surrey estate, Broome Park, Betchworth, to the Association as a home for old people in memory of their son. He emphasized that the Association was no mere dole-granting body, and in fact only regarded pecuniary grants as one of the many means which had to be used.

Mr. L. C. Penwill, chairman of the Court of the Association during the year under review, pointed out that the Association's method included continuous efforts to obtain for beneficiaries the help from other sources to which they were entitled. It was impossible to measure the value in terms of money of the work which the Association had done for the 253 beneficiaries which had been on its books during the year.

In the election of the Council, the following new members were appointed to that body: Messrs. A. F. Bulgin, M.B.E., L. T. Hinton, A. McVie, B. H. Leeson, A. Parkinson, H. S. Pocock, J. W. Ridgeway, O.B.E., and A. B. Wildsmith. At the Court meeting which followed, Mr. L. C. Sharp was appointed chairman.

The main points from the annual report were dealt with in our issue of July 18th (p. 90). The revenue account for the year shows an income of £25,168, as compared with £23,051 for 1945, and total expenditure of £21,018 (against £16,708), leaving a balance of £4,150 (£6,343).

Views on the News

Reflections on Current Topics

A WEEK or two ago I expressed my disagreement with those who criticized the policy of extending supplies to rural consumers at a time when existing consumers face restrictions. On a general question of extensions Mr. Thomas Lockett (Stoke-on-Trent) has some sound comments to make in his annual report. It is, he says, true of electricity supply as of most things in this world that it is impossible to stand still—the industry either goes forward or it goes back. For this reason applications for new and additional supplies are being dealt with even though they may cause temporary embarrassment during the next year or two. That Mr. Lockett has pursued this policy vigorously is evident from the fact that in the face of many difficulties 2,771 new consumers were connected to the supply last year.

* * *

Twice recently I have read reports in the newspapers of villagers being asked to save electricity and gas when they have neither. In the latest case it is stated that every house in a particular village has received a circular from the Ministry of Fuel and Power giving elaborate instructions for reading meters and calling for economy. No doubt the villagers saw the funny side of it, but surely time and paper could be saved by letting the electricity and gas undertakings send these appeals out to their consumers as they have done in the past.

* * *

In the United States at the moment it is apparently the turn of the vacuum cleaner to receive the special attention of manufacturers in the matter of design—these things seem to go in cycles. Until I saw some of the pictures of the new models I thought our latest cleaners were already reasonably well "streamlined," but it seems that we are only at the beginning. The smooth cornerless designs of the new American models with their built-in handles, switches, etc., give a sleek appearance quite different from what we have been accustomed. One model, for instance, looks like a dish cover; the enclosed dust-bag is removed vertically and can be emptied in 5 seconds, while the broad four-point base will not upset and an all-round rubber guard prevents damage to furniture. An automatically-controlled self-adjusting flexible cable on a concealed reel is another refinement which largely overcomes the trailing cable difficulty, and a further innovation is the incorporation of an indicator lamp to show when the bag wants emptying.

* * *

The reduction in atmospheric pollution caused by individual chimneys which could be brought about by a greater use of electricity is an old story, but it needs to be retold until its implications are clear to the public. The recent Parliamentary debates on Bankside power station appeared to show concern only for exceptional buildings, *Smokeless Air* (the journal of the Smoke Abatement Society) complains. It points out that combustion in coal-burning power stations is precisely controlled and that emissions should be negligible, whereas to add the equivalent of 5s. to 7s. 6d. per ton for gas-washing would, by increasing the cost of producing electricity, impede smoke prevention as well as many other things.

* * *

An item of interest from Canada is a report in the *Winnipeg Free Press* that a committee has recommended extensive additional conversions from street cars (trams) to trolley and motor buses. It is recognized that buses cannot handle large volumes of traffic so efficiently as street cars, so it is proposed to retain the latter on the heavily trafficked main route, replacing them by trolley-buses on secondary routes and by motor-buses on feeder and outlying routes. Altogether fifteen trolley-bus routes are proposed. Winnipeg was, I believe, the first city in the Dominion to use trolley-buses, and I have a recollection that they were obtained from this country.

* * *

The Boulder Dam is no more. In future, by official decree of the United States Congress, we are to call it the Hoover Dam instead, as the *Los Angeles Times* has steadfastly done all along. It is very fitting that the ex-President's work for the fulfilment of the project should be recognized, but I am sorry to see the passing of a name so widely associated with a great hydro-electric undertaking.—**REFLECTOR.**

Ohm's Law

By Thomas Carter, M.Inst.C.E., M.I.E.E., Fellow A.I.E.E.

AN article entitled "What is Ohm's Law?" appeared in the *Electrical Review* on January 31st, and was followed by correspondence. The sub-title of the article, "Some Textbook Definitions," indicated its scope, which was largely to show how variable the statements of Ohm's law are. They are indeed astonishingly so; and long knowledge of this has at last prompted me to try to find something definite. My main sources of information in my search have been (*a*) *Gesammelte Abhandlungen von G.S. Ohm*, a book containing, as its title indicates, all Ohm's treatises (and showing a portrait of him that reminded me of Beethoven), and (*b*) the ninth edition of the *Encyclopædia Britannica*. It is difficult to translate some of Ohm's terms, because of the difference of atmosphere between then and now; but his general intention is easy to understand.

Epoch-making Treatise

Georg Simon Ohm, who was born in 1781 and died in 1854, was professor of mathematics in the Jesuits' College at Cologne from 1817 to 1833 and in the polytechnic school of Nuremberg from 1833 to 1852, and afterwards professor of experimental physics in the university of Munich. His writings are described in the *Encyclopædia* as numerous but, except one, not of the first order. The exception is his 1827 treatise, entitled "Die Galvanische Kette mathematisch bearbeitet" ("The Galvanic Circuit, Mathematically Treated"); and it is an epoch-making work, in that it brought order into what had been vague and confused, in the same kind of way as Charles Darwin brought order into biological disorder. Incidentally, I was much interested when I came across what seemed to me to be hints of Ohm's emotional ups and downs scattered through the parts I read of the *Gesammelte Abhandlungen*.

Even if it is granted (as the *Encyclopædia* suggests) that Ohm would not have done what he did unless Fourier had first done his "magnificent work" on the conduction of heat, he nevertheless had the genius to see how the ideas could be transferred; and let it be remembered that he was working in a largely new sphere, with little-understood fundamentals. Ohm used the idea of potential where Fourier used temperature; electric current was analogous to flow of heat; and both men had similar ideas about conductivity. Fourier said that, other things being equal, flow of heat is proportional to gradient of temperature in the conductor concerned: Ohm said that strength of electric current is proportional to gradient of potential.

But how did he say it? In the 1827 treatise he drew a diagram showing the potential existing at each point in the circuit, and in a beautifully clear exposition he linked the gradient of potential (which he called "tension") with what he described as the equivalent length of the conductor, this being its actual length divided by the product of its cross-section and its conductivity. He then examined the strength of the current flowing in the circuit, and came to a conclusion that may be compactly stated by a translated quotation from a later (1831) treatise thus: "If A is the sum of all the tensions in the various parts of the circuit, and L the sum of all the conductor-resistances in the various parts of the circuit; and if by S one understands the magnitude of the current (which is the same in every part of the circuit, and is the quantity of electricity flowing in a given time through every cross-section of the circuit); then $S = \frac{A}{L}$." And that, as I understand the matter, is Ohm's law, as stated in a formula first published by him in 1827.

"Conductor-Resistance"

A comment is necessary on the term "conductor-resistance" used in the quotation in the previous paragraph. In the 1827 treatise Ohm did not use the term "resistance" (Widerstand) at all; he always said "equivalent length" (reducirte Länge). Since the latter is the quotient of actual length and product of area and conductivity (which is the same as resistivity times length over area), it is obviously a quantity of the same kind as that which we now call resistance; but Ohm, referring in 1829 to work by Schweigger, who had evidently used the word Widerstand, said that this word afforded an incomplete picture; and he went

on for a time using the term "reducirte Länge," although at one point he agreed that the two were equivalent, when he wrote of "conductor-resistances, the evaluation of which leads to figures that I have described as equivalent lengths." Towards the end of the 1829 treatise, however, he said, in a restatement of his formula $S = L/A$, that L was "all the resistances (Widerstände) of the individual parts of the circuit"; and apparently he gradually became content to adopt the existing term, and gave up using "equivalent length." This seems to make it clear that it was not Ohm who invented the name resistance for what he designated by L in his formula; and it seems equally clear that Ohm's law can never be properly regarded as "virtually the assignment of a name to the E/I ratio." (Incidentally, it does not matter whether E or V is used in the formula: E implies the inclusion of the source of supply, and V its exclusion.)

Applicability of Law

Ohm's law, as expressed by $S = A/L$, seems to me to be quite generally applicable. If the material having the resistance L is, say, thyrite, with L variable with variable voltage, $S = A/L$ is applicable, with appropriately varying values, from voltage to voltage, and is correct at each individual point. If, on the other hand, the resistance L is constant, but the potential difference A varies (as in an a.c. circuit), the current S varies with A, and the law is still true. If the resistance L varies with temperature, the current S is, from moment to moment, always equal to A/L, whatever may be the value of L at any particular moment. And so on for other conditions: gases, for example, come within the scope, even if it may need a Planck's ideal mind to explain how.

To ask whether $S = A/L$ applies to materials or to a circuit seems quite unnecessary. It may apply to either, though it was first stated in connection with a circuit; that is to say, it applies to a piece of material with a potential difference between its ends, and it equally applies to a circuit containing an e.m.f.

I should like to interject here a note about the word "law" itself, prompted by a reference in the earlier correspondence to the "obeying" of laws like Ohm's, my view being that it is improper to think or speak of "obeying" such laws at all.

In modern times, the word "law" is an unfortunate word, because it has two very different meanings. It may mean a command (e.g. Thou shalt not kill), backed by penalties and rewards, and so a moral affair; or it may mean a generalization (e.g. Ohm's $S = A/L$), backed by nothing but intellectual farsightedness, and therefore apt to be overthrown if new facts arise (compare Newton's law of gravitation and Einstein's law of gravitation), and completely unmoral. As far as I can trace, the use of the word to express both ideas, very different from each other, is a regrettable survival from a time when both kinds of law were thought to originate with the Creator, in that both were in fact His commands, the "thou-shalt-not-kill" kind being directed towards men as moral beings, and the "$S = A/L$" kind towards the material universe. In other words, the discovery of a law like the law of gravitation was taken to be the discovery of how the Creator had enjoined the universe to act, and therefore something fundamental. But that is obviously not true: such an injunction would be absolute, and not capable of subversion with increasing knowledge. In other words, laws like $S = A/L$ are human guesses, however profound: and it is human to err.

Avoiding Confusion of Thought

Unless the two kinds of laws are kept separate in the mind, confusion of thought may easily arise, as when a newspaper describes an aeroplane as "defying the law of gravitation" (a phrase that repays much reflection by leading to the clearing of one's own ideas). It ought to be clear, however, that laws of the "$S = A/L$" kind, being as it were on their trial all the time, are quite wrongly thought of if they are regarded as capable of being obeyed or defied; all that one may say is that they are well-grounded, or not well-grounded, or some equivalent expression, since they are in fact mere statements of what their formulators believed to be true, and what they thought might continue to happen. If the gas laws and Hooke's law are "not strictly obeyed in practice," it is clear they are insufficient statements of the facts they purport to relate to, and require revision.

Now a final word on Ohm himself: he was not accepted by all his contemporaries as having done anything fundamentally important, or even necessarily factual. The *Encyclopædia* says that the value of his work was but imperfectly recognized until it was stamped by the award of the Copley Medal of the Royal Society in 1841. To-day, perhaps, we accept him too lightly; and it was a feeling of this kind that prompted my search.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for correspondents' opinions.

Safe Installations

WITH reference to Mr. A. Jones' letter in your issue of July 18th, I would like to endorse his remarks, except that I do not quite see the necessity for a separate 250-V supply for heating and cooking. In my view, the street supply should be at least 500 V and might even be 1,000 or more (thus saving copper), and transformed on consumers' premises to 50 V for all purposes.

Consumers whose present limit is 25 A would then have a maximum of 125 A, which would not be unreasonable, seeing that the conductors to carry it would only run a few yards in each case. As many as eight houses could be connected to one transformer, except very large houses.

Inside the house, wiring to carry 20 A could be arranged for fires which now take 4 A and pro rata.

*London, W.*13. ARTHUR WRIGHT.

Staffing and Management

I AM grateful to Mr. H. J. Bentley for his letter of comment on the first part of my article, and for the opportunity of expanding my brief paragraph on " motives."

First of all, let me assure Mr. Bentley that we are not at variance on the two points he raises. I agree that moral judgments are individual and personal, and therefore should not be allowed to bias a selection decision. I agree too that good " managers " in an engineering or accountancy sense do not necessarily make good staff managers. I hope that the second part of my article, in which I stress the value of " human relations," and give my views on the attributes of the successful staff manager, will go some way to indicate that only " technique " was in my mind when I wrote " management of staff differs little from management of anything else."

On the question of motive, I contend that unless the interviewer has this " pointer " in mind it may be overlooked, especially if the applicant scores heavily on other points; and though the till may not be emptied it is possible that the applicant may be using the position as a stepping stone to something else. That does not imply condemnation, but it is useful to know the expected pause on your " stone." As Mr. Bentley knows, competence or ability to do a job are insufficient unless there is present the will to work; and I think this is the most appropriate of the seven pointers under which to appraise this trait, as well as the possible satisfaction that the work will give to the applicant.

I stressed the importance of this section, because I think the interviewer should endeavour to ascertain during the interview in what proportions are mixed the three fundamental reasons for a man's working, namely: hope of reward; fear of penalty; and inspiration an ideal.

*London, S.W.*1. G. O. MCLEAN.

IT is suggested by Mr. G. O. McLean that in all the welfare schemes which it is hoped will be initiated by the British Electricity Authority the Area Boards will have the active co-operation of the trade unions. It may not be widely known that the constitution of the existing National and District Councils for the manual side of the supply industry provides for consideration of " general matters relating to welfare work," " the improvement of health conditions and the provision of special treatment of workers," " the supervision of entry into and training for the industry and arranging education for the industry," and " the arrangement of lectures and holding of conferences on subjects of general interest to the industry." These important matters have been almost entirely neglected by the Councils to the detriment of the industry. May we expect that both managements and trade unions will heed Mr. McLean's plea for " serious thought to be given to the question of personnel policy for the integrated supply industry " and that at future meetings of the Councils these matters will receive regular and serious consideration?

With regard to the Whitley Councils to be established for the clerical and commercial staffs, the industry will be able to count on the fullest co-operation of the N.A.L.G.O. representatives whose organization has been the pioneer in the local government field of all such educational and welfare schemes as Mr. McLean recommends for adoption by the Boards. Indeed, so far as the municipal electricity undertakings are concerned many of Mr. McLean's suggestions are already in operation. As regards staff rating, too, it

would be difficult to improve upon the "Annual Report on Members of the Staff" contained in Appendix A of the "Scheme of Conditions" of the N.J.C. for Local Authorities' Staffs. (Copies obtainable from N.A.L.G.O. branch secretaries.)

The personnel officer must obviously have the necessary training for and aptitude for his task, and new entrants into the industry should receive a booklet outlining the conditions of employment, works or office rules, details of social amenities, etc. Consideration should also be given to the establishment of local works councils and staff committees.

Perhaps in another article Mr. McLean will give us his ideas on the staffing of individual offices with particular reference to the method followed, I believe, by the banks and civil service of fixing the "establishment" for each office, that is the minimum staff requirements in relation to the volume of work, etc. Also, it would be interesting to have his views on an appropriate professional examination for clerical and commercial staffs of the industry and his comments on the promotion examination recently established for local government staffs including those employed in electricity undertakings.

Another matter which will require early attention by the Boards is the establishment of a quite distinct and separate commercial department in each undertaking where it does not already exist.

Does Mr. McLean expect—as I fear we must—that there will be a rather large increase in staff following nationalization? It is a fact, I believe, that many undertakings or departments are understaffed and reorganization will itself demand an increase, but the public and many in the industry will no doubt put the blame for this on nationalization!

Camborne, Cornwall. F. O. PASCOE.

Paralleling Diesel Sets

THE merits of "lamps-bright" or "lamps-dark" for synchronizing have received consideration in connection with the 1,500 Government-sponsored 55-kW Diesel-electric plants being manufactured to meet next winter's emergency supplies. Synchronizing with "lamps-dark" was adopted for the following reasons :—

(1) The "lamps-bright" method is satisfactory when the neutral of the incoming machine is not connected to the neutral of the running machine; but when running up a machine to take another out of service, it is often desirable to connect the neutrals before doing so, in order that the earth connection should not be interrupted. In this case with "lamps-bright" the lamps do not reach the maximum intensity simultaneously and it is extremely difficult to decide the point at which the lamps are of equal brilliance.

(2) "Lamps-dark" indicates no potential between the blade and jaw of the switch of each phase and leaves no doubt about the safety of closing the switch.

(3) A series of tests was made to assess the angular disparity which could be expected using the two methods and with "lamps-bright" it was found that synchronizing was effected with 60 deg displacement whereas with "lamps-dark" this was reduced to 20 deg angular displacement.

FOR ASSOCIATED BRITISH OIL ENGINES, LTD.
*London, S.W.*1. H. G. POOLE.

Municipal Reports

THE accounts of the Leicester Electricity Department (general manager, Mr. John Mould) for the year ended March 31st last show an increase in gross revenue of £109,708 to £1,095,743. Working expenses rose by £179,487 to £1,060,307, and after meeting loan charges and income tax, etc., there was a deficit on net revenue account of £21,114 compared with a profit of £25,171 in the previous year. Sums totalling £73,061 have been brought from sale of fittings reserve, hire-purchase apparatus and assisted wiring accounts, leaving a balance of £51,947 to be carried forward.

The Department generated 338·2 million kWh against 305·8 million in 1945-46 and sold in its area 255·2 million kWh (216·6 million) at an average price of 1·003d. per kWh (against 1·060d.).

A 48 per cent increase in supplies under "all in" tariffs is recorded in the 1946-47 annual accounts of the Scarborough Electricity Department (engineer and manager, Mr. W. K. Fleming). Sales in this category totalled 18·7 million kWh at an average price of 1·31d. compared with 12·6 million kWh at 1·40d. in the preceding year. Altogether, excluding bulk supply, the Department sold 30·4 million kWh against 22·7 million in 1945-46, an increase of nearly 34 per cent. The average price received for all supplies, including bulk, was 1·60d. (against 1·77d.). Total revenue increased by £44,340 to £242,853 while working expenses rose by £44,608 to £180,409. After meeting loan charges, £40,266 (against £41,287), and income tax £16,659 (£20,883) and making provision for depreciation there was a net profit of £4,758 (£189).

PERSONAL and SOCIAL

News of Men and Women of the Industry

THE Metropolitan-Vickers Electrical Co., Ltd., announces that **Dr. C. Dannatt,** chief electrical engineer, has been appointed to the board.

Mr. H. Paterson, M.I.E.E., manager of the Newcastle-on-Tyne office of the Metropolitan-Vickers Electrical Co., Ltd., and **Mr. C. Petersen,** manager of the company's Manchester office, have recently relinquished their duties and have been succeeded respectively by **Mr. A. J. Crawford** and **Mr. J. B. Hartley,** M.C., M.I.E.E. Both Mr. Paterson and Mr. Petersen will remain available for consultation until the end of the year.

Mr. Paterson joined the former British Westinghouse Co. in October, 1902, starting in the Specification Department. In 1906 he transferred to the Newcastle District office, and was appointed manager in February, 1919. He was chairman of the North-Eastern Centre of the I.E.E. in 1928 and is a member of the North East Coast Institution of Engineers and Shipbuilders and of the Association of Mining Electrical and Mechanical Engineers.

Mr. Petersen joined the Rolling and Winding Engine Department of the British Westinghouse Co. in April, 1914, and took full charge a few months later. He then became manager of the Plant Sales Department, and subsequently

Mr. H. Paterson

Mr. C. Petersen

combined this with the managership of the Motor Sales Department. In 1926 he became district manager of the company's London office, returning to Manchester in the following year as district office manager there.

Mr. Crawford joined the British Westinghouse Co. as a school apprentice in December, 1912, and after completing his apprenticeship (broken by army service from 1914 to 1919) gained experience in various commercial departments of the company. In 1925 he transferred to the company's Glasgow office and remained in Scotland until 1946, when he was appointed assistant manager at Newcastle. During the last war Mr. Crawford served for a time as a captain, R.A., with the 51st Highland Division, afterwards becoming a staff lieutenant-colonel in the Glasgow Home Guard. He is a member of the North East Coast Institution of Engineers and Shipbuilders and of the Associa-

Mr. A. J. Crawford

Mr. J. B. Hartley

tion of Mining Electrical and Mechanical Engineers.

Mr. J. B. Hartley was educated at Burnley Grammar School and Technical College and received his practical training with the Corporation Electricity Department. He joined the British Westinghouse Co. in 1913 and after war service from 1915 to 1919 when he was awarded the M.C., he returned to Manchester as a sales engineer in the Plant Department of the company. Two years later he transferred to the Manchester office and in 1931 became chief assistant to the district office manager. He was appointed assistant manager in 1946.

Mr. R. W. L. Harris, B.Sc., M.Inst.C.E., M.I.Mech.E., M.I.E.E., registrar and secretary of the Professional Engineers' Appointments Bureau, was married to Miss A. M. Jones on July 22nd at the King's Chapel of the Savoy.

Mr. O. G. Cook, A.M.I.E.E., chief electrical engineer and manager to the Bingley Urban District Council has been elected chairman of the Incorporated Municipal Electrical Association, Mid-East England Centre. Mr. Cook has been vice-chairman for the past two years, and for some years has been a member of the Council of the I.M.E.A. The Bingley Council has adopted the National Joint Committee's scale of salaries for chief electrical engineers.

The following new appointments have recently been made in the Sheffield Corporation Electricity Department:—Assistant consumers' engineer: Mr. W. H. Burton, at present distribution engineer with the Doncaster Corporation. Assistant mains engineer: Mr. D. J. Agnew, at present junior mains assistant with the Colchester Corporation. Junior operation shift engineer: Mr. G. E. J. White, at present switchboard attendant with the Luton Corporation. Junior

assistant engineers: Mr. A. Large, B.Sc. (Eng.), previously junior engineer with the Metropolitan-Vickers Electrical Co., Ltd., and Mr. F. J. Williams, previously assistant control engineer at Coventry.

Mr. R. M. Parry has been elected to the board of directors of the British Driver-Harris Co., Ltd., and has been appointed assistant managing director of the company.

Mr. N. B. MacArthur, electrical engineer and manager of the Inverness Electricity Department, informs us that the increase in his salary has now been approved by the Corporation. He points out, however, that his salary is £900, excluding war bonus (not including bonus as stated in our July 18th issue). His full salary, including war bonus and emoluments, is £1,025 per annum as from February 15th last.

Mr. A. Williams, resident engineer at Stuart Street power station, Manchester, retired on July 31st, after thirty-nine years' service.

Mr. J. Valentine, London sales manager, has now been appointed sales director of the British General Mfg. Co. (1941), Ltd.

Mr. F. R. Robbins, formerly assistant sales manager of Belling & Co., Ltd., has been appointed export manager to the company. **Mr. R. P. Dean,** formerly sales engineer, Eastern Counties, has been appointed assistant export manager.

Mr. M. W. Callender, who has been with the Wessex Electricity Co. as a substation switchgear maintenance engineer since December 1st, 1942, is leaving at the end of July to take up an appointment as a district engineer with the Municipality of Singapore.

Mr. G. L. Grimwood, who has recently been released from the Forces as captain, R.E.M.E., has been appointed design and development engineer to Stamford Electrical, Ltd. Mr. Grimwood was formerly with Bull Motors.

Mr. R. J. F. Howard, late of the Mullard organization and until recently in charge of the development laboratory of the Industrial Electronics Section of the English Electric Co., Ltd., has joined British Electronic Products, Ltd., as chief engineer. **Mr. B. J. Townsend** has also joined the staff in the Engineering Department.

A large gathering of staff and employees of the Gloucester Corporation Electricity Department and their families attended the second annual sports held recently on the Department's cricket ground at Castle Meads. Members of the Council who were present included the City High Sheriff (Mr. B. C. Meehan) and Alderman Clift (chairman of the Electricity Committee). A number of retired members of the Department were especially welcomed by Mr. Emil Braathen, the chief electrical engineer. Various side-shows, mostly electrical, afforded great interest and amusement to the spectators. The prizes were presented by Mrs. Emil Braathen. Mr. G. Hill acted as starter, and the arrangements were in the hands of a committee with Mr. H. E. Franklin as chairman, Mr. I. F. Chater as treasurer and Mr. K. M. Robins as secretary.

On July 19th Metway Electrical Industries, Ltd., of King Street, Brighton, took the whole of its staff for an outing. This consisted of a motor-coach drive from Brighton to Guildford, and from there on to Windsor, where lunch was served at the Windsor Bridge Restaurant. After luncheon they went by steamer to Hampton Court.

The annual staff outing of Frank Westerman (Wholesale), Ltd., took place on July 19th, when a party of 64 went to Tenbury Wells. The afternoon sports were dominated by the members of the Industrial Electrical Department who also greatly contributed towards the evening entertainment, held in the ballroom of the "Royal Oak," Tenbury. Mr. F. Westerman distributed the prizes.

Obituary

Mr. A. P. Trotter,—The industry has lost another of its pioneers in the death at his home at Salisbury on July 23rd of Mr. Alexander Pelham Trotter, B.A. (Cantab.) who was in his ninety-first year. Mr. Trotter will be particularly remembered for his work on illumination photometry and his early researches on prismatic glassware and kindred subjects. He was the author of "Illumination, its Distribution and Measurement" and "The Elements of Illuminating Engineering" and the first of many patents to his credit was for "apparatus for distributing and diffusing powerful lights" (1881 and 1883), afterwards developed by Holophane, Ltd. In recognition of his work he was in 1941 elected an honorary member of the Illuminating Engineering Society, of which he was a past president.

Mr. Trotter was born at Woodford, Essex, and educated at Harrow and Trinity College, Cambridge. In 1884 he entered into partnership with W. T. Goolden at Halifax as Goolden & Trotter, makers of dynamos and electrical apparatus, and in 1886 commenced practice as a consulting engineer. Following a short period as technical secretary of the Electrical Trades Section of the London Chamber of Commerce he became editor of the *Electrician*. In 1896 he went to South Africa as Electrical Engineer and Inspector to the Government of the Cape of Good Hope, returning in 1899 to become Electrical Adviser to the Board of Trade, which position he held until 1917 when he joined the firm of consulting engineers, Handcock, Dykes & Trotter. He retired in 1920. He was a member of the Institutions of Civil and Electrical Engineers and a past president of the Association of Supervising Electrical Engineers. Last year Mr. and Mrs. Trotter celebrated the diamond jubilee of their wedding which took place at Paddington on June 30th, 1886.

Dr. Alfred Ekström.—The Swedish journal "ERA" reports the death on June 29th of Alfred Ekström, of Fittja, at the age of seventy-three years. After the award of his doctor's degree at the University of Uppsala in 1897 for a dissertation on electrical waves and further studies at the Polytechnical in Zurich, Switzerland, Dr. Ekström became manager of the AB Telefonfabriken in Stockholm and later joined the L.M. Ericsson concern, helping to develop the central battery system of operating telephone exchanges. He transferred to the power industry in 1906, established the Hemsjö Kraft AB and was its managing director until 1920 when that company was amalgamated with Sydkraft. He was for many years secretary of the (Swedish) National Federation for Rural Electrification and of the Electrical Association of the Mälar Province, being also a member of the Electrification Commission and of the Executive Committee of the Power Works Association.

Dr. Ekström was elected M.I.E.E. nearly twenty years ago when he came to England with his son Vidar and remained for several years, assisting to design overhead-line distribution schemes then being submitted for Mid-Lincolnshire. Their joint contributions to the *Electrical Review* included a comparison of Swedish and British regulations for overhead lines; a description of rural electrification by the Swedish Electricity Board, illustrating the influence of price of energy on consumption; also articles on electrically heated hotbeds, residential heating and on a novel water heater. Upon his return to Sweden, Dr. Ekström, in recent years, devoted himself more particularly to the laundry industry, advocating its rationalization by the introduction of scientific methods.

Mr. William Frederick Taylor, whose death at his home at Bedlams Wood, Rockshaw Road, Merstham, Surrey, occurred on July 26th, was retired in 1939 as assistant controller, London Telecommunications Region G.P.O. after forty-three years in the telephone service.

Safeguarding Power Supplies

Plans for Adjusting Industrial Hours

As briefly announced in our last issue, the Minister of Labour made a statement last week outlining the Government's plans for safeguarding next winter's supplies of power for industry. The demand for electricity, Mr. Isaacs said, had risen by 70 per cent since 1939 and was still rising. If nothing were done almost daily cuts in power would cripple industry and recovery would be gravely prejudiced.

Various methods would have to be adopted. Day-shift hours could be adjusted in different factories so that some started after the morning peak and others ended before the afternoon peak; some factories could work staggered day shifts, others night shifts; rota schemes could be operated. There was also the question of the terms and conditions under which revised working hours should operate and here the recent engineering industry agreement afforded a useful lead.

The Government had laid upon the Regional Boards for Industry the task of working out the plans to achieve the regional target of moving one-third of the peak load outside the normal day-time period. They could not disregard the possibility that there might be cases of unreasonable failure to operate approved schemes and had decided that compulsory powers must be used to deal with such cases. Once a case had been established a direction would be issued under the Defence Regulations by the Minister of Fuel and Power compelling the firm, under penalty, to reduce its maximum demand to the required level. The district or other local committees of the Regional Board would bring such cases to notice and the Regional Board would be required to satisfy itself that a case had been established. Before action was taken each case would be further examined by the Electricity Sub-Committee.

This matter would be kept under close review to consider whether any more stringent action was necessary, and a central record of such cases would be maintained for reference to other Government Departments should additional action be deemed necessary. The Government hoped that such powers would be required only very exceptionally.

It must be realized that the position of the domestic consumer in this matter was also vitally important. Everyone could help industry by avoiding the use of electricity during the peak periods.

Asked by Mr. Eden what was the Defence Regulation referred to, Mr. Isaacs said it was Regulation 55-2A, under which anybody failing to observe a direction was liable to prosecution, and in the event of a successful prosecution, the penalties went as high as £500 or one year's imprisonment. That was only where there had been an unreasonable failure. It would not be used as a direct penalty.

Replying to a suggestion by Mr. Eden that he should consider proceeding under an Order, Mr. Isaacs said that if an Order could be made he would gladly do that.

Mr. Hobson asked the Minister if he was satisfied that it would be possible for the power stations to carry out their essential repairs which were usually done in the off-peak periods?

Mr. Isaacs said that that point was outside his scope, but all he had spoken of was being done in the closest co-operation with the electrical engineering organizations.

Police Radio Equipment

Demonstration of V.H.F. Outfit in London

THE latest type of radio-telephony apparatus for police cars as ordered by the Home Office from Marconi's Wireless Telegraph Co., Ltd., for use throughout this country was demonstrated last week in London between a "control station" in Queens House, Kingsway,

Mobile police radio-telephony outfit, showing car dashboard (top) and transmitter with receiver in the luggage "boot" behind

and a car patrolling the West End through the dense street traffic of mid-afternoon.

The transmitter, of quite modest dimensions, at "station headquarters" operates on one frequency chosen from within the 75 to 100 Mc/s band. The controlling crystal oscillates at a relatively low frequency, successive valve circuits being utilized for finally selecting the eighteenth harmonic, which is amplified to become the radiated carrier, delivered at a power level of the order of 45 W to the aerial feeder.

The carrier is modulated by speech into the microphone circuits, the modulator amplifier being designed to pass all the audio-frequencies (± 1 db from 200 to 5,000 c/s) necessary for speech of superior quality, individual speaker's voices being easily recognizable.

Since the best position for a v.h.f. equipment is as near the aerial as possible, the transmitter and receiver (both using the same aerial) are situated at the aerial site and remotely controlled. The changeover from "send" to "receive" is effected by a relay operated from a press switch on the distant microphone. Full control is possible over ordinary telephone lines up to a distance of three miles and two or three widely separated transmitters may be controlled from the one remote position for "diversity" transmission, a method used to combat fading and the "blackout" of signals, due to the presence of steel buildings and other obstructions. The extreme range of this equipment is about 30 miles.

The mobile outfit demonstrated is a complete radio-telephone set working on the same "spot" frequency in the 3·5 m wavelength band as the headquarters transmitter, but energized from the car 12-V battery. The 10-W transmitter and receiver fit together on a light metal rack mounted on shock absorbers and installed in the luggage "boot" of the police car. The whole equipment is controlled from a small panel on the dashboard of the car, the loudspeaker and the hand microphone being conveniently placed for the use of the operator.

A traffic-control loudspeaker can be fitted on the outside of the vehicle and, by operating a switch on the dashboard, the operator is able to control the external speaker from his hand microphone.

The mobile transmitter is crystal controlled and both the receivers are crystal-controlled double superheterodynes with an extremely low noise level to ensure that signals are clearly intelligible through the interference.

A single roof-mounted flexible aerial is used for transmission and reception. The size of the apparatus has been reduced by comparison with former equipment of this kind and, although designed primarily for police service, it is equally suitable for other mobile communication, such as in harbours and docks, fire-fighting services as well as for surveying and prospecting operations.

Woman's Fair Exhibition

The latest designs in household and kitchen equipment, and also many electrical appliances, will be shown at the Woman's Fair Exhibition, organized by *Woman*, to be held at Dorland Hall, Regent Street, S.W.1, from September 23rd to November 22nd.

Electricity Bill

Committee Stage in the House of Lords

LAST week in the House of Lords the Electricity Bill was considered in Committee. It was reported to the House on Tuesday last and was down for third reading yesterday (Thursday).

In the course of the committee Croceedings Viscount Swindon put forward a proposal that electricity holding companies with 25 per cent or less non-electrical assets should be allowed to continue in existence, being given Electricity Stock for their electrical assets. The Lord Chancellor said that he could not accept this amendment but suggested that the companies concerned might form separate companies to take over the non-electrical assets before the vesting date.

In response to a suggestion by Lord Swinton, the Lord Chancellor said that he would endeavour to find some form of words providing that the vesting date should not be earlier than April 1st of the year in which the industry was taken over.

On Clause 2 (Additional Functions of Electricity Boards), Viscount Swinton moved an amendment to omit the proviso enabling the Central Authority to manufacture electrical plant and fittings. He had nothing to say against the right given to Area Boards to sell those fittings, but that was a very different thing from manufacturing. He could not conceive that in any circumstances the Central Authority would really go into this business, which was most complex, requiring vast machinery and great knowledge. He would support the breaking up of "rings," but the worst way of breaking a ring, if it existed, was to go into a very complicated and highly technical and scientific industry like this and try and manufacture the goods.

Lord Lloyd supported the amendment, saying he was sure that the Government had no intention of using their powers in this connection, and it was bad legislation continually to take powers which were not to be used. If there were a "lamp ring," surely the right way to stop it was to have it investigated by a Royal Commission.

Defence of E.L.M.A.

Lord Wolverton, who also supported the amendment, said that references had been made to a "lamp ring," but he had been supplied with some figures which were quite convincing. The Electric Lamp Manufacturers' Association, which represented a number of the largest lamp manufacturers in Great Britain, in the year 1921 produced 20,000,000 lamps of 60-W size, the retail price of which was 5s. 6d. each. In 1939 they produced 83,000,000 and the price dropped to 1s. 7d. each. In 1945 they produced 109,000,000 and the price then was down to 1s. 3d. That was quite clear evidence that they had been driving down prices very rapidly. It should not be forgotten, however, that many organizations of this kind were set up in the difficult times between the two wars, when there was not a sellers' market but a buyers' market, and it was very difficult to protect the British industry from foreign competition. Calling attention to what the Association had been doing lately, he said that in the first quarter of 1938 its members exported 4,900,000 British lamps, and in the first quarter of 1947 they exported 9,100,000, helping us to get badly needed foreign currency.

The Earl of Lytton found it impossible to support the amendment. He agreed that they clearly did not want the Central Authority to go in for manufacturing electrical plant on a large scale. But the amendment might have a more restrictive effect than was realized, and might impair the efficiency of the industry. The power had been used in the past by the interests concerned for such purposes as setting up a foundry to make their own spare parts, or setting up engineering shops for the manufacture of special parts which they used in their plants. Further, it was very important that the generating authority should have the power to manufacture on a laboratory scale for experimental purposes in order that they might secure the best development of electrical plant.

"Bare Cost Prices"

Lord Lucas hoped the Government would retain this power as an offensive weapon. He hoped the Central Authority would use the power to enable it to supply consumers with all the fittings and machines, including lamps, they wanted at bare cost prices, if the private enterprise manufacturing industry could not supply them.

The Lord Chancellor said that the Government took the view that it would be a mistake to omit this power. It must obviously be retained for experimental purposes. He agreed that it was difficult to see where experiment ended and generation began. But he said quite frankly that they did not anticipate they would have to go into large-scale manufacturing so far as one could perceive, at any rate for the next few years, except as a weapon of defence. The Government must have this power in case they found themselves hardly dealt with by rings. But he gave the assurance that, so far as large-scale manufacturers were concerned, it was not intended that this power would be used except where danger of such practices as he had referred to arose. If there were no objectionable practices, these powers would remain in abeyance ; if there were grounds for supposing

that they were not getting things they required on reasonable terms, or as cheaply as they might, then they would hold these powers in reserve. It might well be that the mere fact that they had these powers might make it unnecessary to to use them.

The amendment was, by leave, withdrawn.

Viscount Ridley moved an amendment to enable the Central Authority to delegate its operational powers in certain circumstances to the Area Boards. He said that the reasons for suggesting the complete integration of generation and distribution so far as possible in an area were very strong. If electricity in future was not supplied to industry at the terms and on the conditions needed, industrial concerns could obtain power by the installation of their own plant, using process heating and so on; so that each Area Board must have a good deal of commercial flexibility.

The Earl of Lytton, Viscount Elibank and Lord Wolverton supported the amendment.

Viscount Hall, the First Lord of the Admiralty, said that the Weir Committee in its report definitely recommended that generation and main transmission should be separated from distribution. He wondered, if the amendment were carried out literally, how far the Area Boards could go. Did it mean that there should be a kind of inquiry about the economic generation of electricity for each of the 142 selected generating stations, or, indeed, for many others from whom the Central Electricity Board purchased electricity? In his view and that of the Government it was absolutely imperative that the Central Authority should be responsible for the generation of electricity. The Area Boards, if they did their job well, would have as much as they could do in looking after the distribution side and developing it in areas where the people were clamouring for a supply of electricity. He could not accept the amendment, and could see no case made out for it.

The amendment was, by leave, withdrawn.

Appointment of Area Boards

On Clause 3 (Constitution of Central Authority and Area Boards), Viscount Swinton moved an amendment to empower the Central Authority, instead of the Minister, to appoint the Area Boards. He said that there were fourteen of these Boards, and there was power to add to their number. There could be only one reason for vesting this power in the Minister and that was to give him the great power of patronage. It was wrong in principle, wrong in administration, wrong in every business precedent, and it was wrong politically.
was any doubt about it the Minister had made it plain in a considered speech in which he said he would not put on any of these Boards a man who was opposed to nationalization.

Lord Rennell, Lord Lloyd, Viscount Ridley and the Earl of Lytton supported the amendment, but Viscount Hall resisted it. He said that the Government was convinced that while a certain amount of co-ordination of the activities of the Area Boards was necessary, they should be powerful bodies as far as possible untrammelled by supervision by the Central Authority in the exercise of their day-to-day functions. For that reason it was proposed that members of the Area Boards should be appointed by the Minister.

The Marquess of Salisbury described the position of the Government as very unconvincing. Was it really true that the Area Boards were independent? The Central Authority was to give directions to them.

The Lord Chancellor undertook to devise some form of amendment which would make it plain that the Minister should consult the Central Authority before he appointed the Area Boards.

The amendment was, by leave, withdrawn.

Viscount Hall accepted an amendment, which was agreed to, to secure representation of the agricultural industry on the Area Boards.

Compensation to Companies

After Clause 20, Lord Rennell moved a new clause (Adjustment of Compensation to Holders of Securities Other than Local Authorities). He said that the practice of valuing public utility undertakings on other than a Stock Exchange basis had frequently been adopted. His new clause provided the alternative of taking Stock Exchange valuations or a valuation based upon arbitration on the claim of either party and not of one party only.

In the debate which followed, the Lord Chancellor said that he had no concession to make. The system adopted was fair and he was surprised at the challenge. Was it unfair that the test which was taken as a fair test for death duties should be taken as the value of these shares? He believed the Stock Exchange value to be fair and reasonable.

The proposed new clause was, by leave, withdrawn.

Lord Rennell moved a further amendment dealing with compensation payable to local authorities in respect of severance, and providing for settlement by arbitration. The Lord Chancellor, however, resisted this proposal too, and the amendment was withdrawn.

On Clause 37 (fixing and variation of tariffs) Viscount Ridley moved a proviso to make it clear that in fixing a tariff for a new Board, the Central Authority should take into account the cost of electricity generated within the area of, and supplied to, the Board. He said that he was moving the amendment on industrial grounds. At present, under the 1926 Act, companies owning selected stations were protected in the charge which was made to them. In effect, at present the cost of electricity, was directly reflected in the cost of generating in that area. The alternative for an industrial plant of any size, if the undertaking found the electricity expensive, was to generate its own electricity, which it was entitled to do, to com-

bine with a neighbouring firm, and to share the generating plant with them, or to use other forms of power. All those were alternative sources of energy which were subject to the local price of fuel in the district. It was for that reason that electricity ought to have the same sort of ratio of prices in one district as in another.

The Lord Chancellor said that he was not prepared to accept the amendment. The noble Viscount had made out a strong case, but the Government were nationalizing and not regionalizing the industry.

The amendment was, by leave, withdrawn.

Viscount Ridley moved another amendment to ensure that tariffs should be calculated by methods in accordance with principles submitted by the Central Authority to the Minister and Parliament, and published.

Viscount Swinton supported the amendment.

The Lord Chancellor agreed with the necessity for full publicity as a safeguard in these matters. It prevented corruption creeping in. As to the rest of the amendment, he would gladly consider the desire that the tariff should be approved by the Minister.

Viscount Swinton said that the really important thing was that the principle on which the tariff was based should be published.

The Lord Chancellor undertook to look into the matter with the Minister, and the amendment was, by leave, withdrawn.

Before the proceedings ended the Government was defeated on a new clause, moved by Viscount Swinton, to provide that, on the dissolution of the Electricity Commissioners, an electricity appeal tribunal should be set up to approve maximum tariffs and also to hear representations from individuals and groups of individuals.

Lord Rennell, supporting the new clause, said that he saw no other course open in justice to the consumer than to safeguard his rights by giving him a right of appeal.

After Lords Wolverton, Lloyd and Elibank had supported the new clause, the Lord Chancellor resisted it, arguing that it would lead to hopeless duplication of the work of the Consultative Councils which were to be established under the Bill. They would be reduced to the level of ornamental figures. In view of the safeguards already provided, the clause would merely provide an illustration of "crossing the wires." Multiplication of safeguards would merely lead to a weakening of them.

The new clause was carried against the Government by 28 votes to 11, and the Committee stage was concluded.

PARLIAMENTARY NEWS

By Our Special Reporter

IN the House of Commons last week Mr. Janner asked the Minister of Supply what approximate proportion of the 3,028,482 electric fires produced in this country from January, 1946, to May 31st, 1947, were for sale in the home market.

Mr. Wilmot said the answer was about 85 per cent.

Atomic Energy Plant

Mr. Wilmot, Minister of Supply, in a statement about the proposed atomic energy plant in West Cumberland, said that on January 29th, 1946, the Prime Minister announced the setting up of an organization to be responsible for the provision of fissile material. It had since been announced that the first stage of this process, viz., the production of pure uranium from pitchblende concentrates, would be carried out at the Ministry of Supply factory at Springfields, near Preston. Consideration had been given to the location of the second stage of the process, viz., the production in a chain-reacting pile of fissile material from the uranium produced at Springfields. At one stage it was thought that the requirements could only be met by the use of the former explosives factory at Drigg in West Cumberland. Sellafield, a few miles north of Drigg, had proved to be technically more suitable, and the atomic energy project would be located there. Building and engineering work would begin in the near future, and would give employment to a considerable number of men for some time to come. For the time being, there would be no change in the present use of the Royal Ordnance Factory at Drigg.

Restrictions on Domestic Users

Mr. Haire asked the Minister of Fuel and Power whether he was satisfied that domestic users were carrying out the restrictions imposed on the use of fuel during the present summer months; and if he would state his estimate of the amount of fuel saved to date.

Mr. Shinwell said it was not possible to state whether in fact the summer restrictions on the use of gas and electricity were being fully observed by all consumers. Domestic consumers had been asked to economise in the use of gas and electricity this summer so as to enable the gas and electricity undertakings to use 2½ million tons less coal than they estimated they would consume during this period. So far consumption of coal by these undertakings had been about 900,000 tons less than was estimated. The statistics which were available did not, however, enable him to inform the hon. member how much of this saving had been due to the domestic consumer.

Fuel Returns

Power Station Efficiencies in 1946

LEEWAY is being made up in the publication of the Electricity Commissioners' annual returns "Generation of Electricity in Great Britain," more familiarly known as "The Fuel Returns." Those relating to 1945 were dealt with in the *Electrical Review* for April 18th last, and those for 1946 are now available (H.M. Stationery Office, 2s. 6d. net). Particulars are given of kWh generated and sent out from 344 stations operated by authorized undertakings during the year ended December 31st, with fuel consumption, thermal efficiency and load factor of each, based on kWh sent out. Separate sections of selected stations are counted as one station.

These 344 stations generated 41,233 million kWh (10·6 per cent more than in 1945), of which 5·6 per cent. was used on works, and burned 25,483,933 tons of coal and coke (11·7 per cent increase) and 34,067 tons of oil fuel as against 19,741 in the previous year. Six stations had individual outputs exceeding 1,000 million kWh. In an appendix are given corresponding particulars for twelve traction stations and four non-statutory (waste-heat) stations; the former generated some 1,489 million kWh and the latter 60 million kWh for an aggregate consumption of 1,096,268 tons of coal and 33 tons of fuel oil.

Order of Merit

Of the 207 coal-fired stations, which produced 96·84 per cent of the total and consumed 25,500,137 tons of coal, Battersea (London Power Co.), with 0·96 lb per kWh sent out, maintained its leading position for low fuel consumption, but Hams Hall "B" (Birmingham) took first place for thermal efficiency with 26·79 per cent, which was 0·3 per cent better, with a fuel consumption of 1·4 lb per kWh. Close behind was Llynfi (South Wales Power Co.) with 26·17 per cent and 1·05 lb. Other stations with thermal efficiencies higher than 25 per cent (sent out) were Dunston "B" (North-Eastern Electric Supply Co.), Fulham, Earley (C.E.B.), Barking "B" (County of London Co.) and Little Barford (B.C. & H. Co.). Coming between 24 and 25 per cent were Littlebrook (Kent Power Co.), Mexborough (Y.E.P. Co.), Kearsley (Lancs. Electric Power Co.) and Taylor's Lane (Northmet Co.). Three more stations returned figures higher than 23 per cent, viz., Ironbridge (West Midlands J.E.A.), Brimsdown "A" (Northmet Co.) and Clarence Dock (Liverpool). The highest load factor was the 72 per cent reached by Hams Hall "B." Average coal consumption for all steam stations was 1·52 lb per kWh compared with 1·51 lb in 1945.

Thermal efficiencies above the highest obtained with steam were established by twelve of the eighty-eight oil-engine stations (which sent out 49·8 million kWh, with an average fuel consumption of 0·68 lb per kWh), headed by Ilfracombe with 31·67 per cent thermal efficiency. Two gas engine stations generated 1·36 million kWh with a fuel consumption of 2·25 lb per kWh, and five waste-heat and waste-gas stations produced 42·15 million kWh. There were also forty-two water-power stations with an aggregate output of 1,137 million kWh, 2·92 per cent of the total. Ninety-one stations in the S.E. England area generated 27 per cent of the total.

Australian Cable Manufacture

THE Australian electric cable manufacturing industry which was started as recently as 1940 by the Olympic Tyre & Rubber Co., Ltd., at West Footscray, Melbourne, is now being carried on and extended by a separate affiliated company—Olympic Cables, Ltd.

Early in the war the export of cables from England to Australia was discontinued and for about two years the Olympic cable department was the only source from which material for the wiring of Government and privately-owned factories could be obtained. Later cables were made for the supply of power to coastal searchlight batteries and for degaussing ships. Then came a request for 75,000 miles of field telephone cable, for the manufacture of which the Olympic Co. had the co-operation of three other Australian concerns which were equipped to handle some of the preliminary operations. At this time an entirely new cable-making plant had to be provided for the Olympic Co. at West Footscray. The quantity of field telephone cable eventually produced during the war was almost 175,000 miles.

The range of cable products has been steadily increased; in addition to standard lines, over 400 special types of cable have been produced. The company plans to meet the full needs of the aircraft, automobile and radio industries.

Industry and the House

Power Supply and Demand

By F. J. Erroll, M.A., A.M.I.E.E., M.P.

JULY has been a trying month for Ministers concerned with fuel and power. While the sun beat down on New Palace Yard, one member of the Government after another has risen to defend its policy, to explain why the nation shivered and came almost to a standstill last winter, and assess the chances of escaping a similar fate next winter. On the whole—despite an array of talent that included Mr. Wilmot, Mr. Shinwell, Mr. Morrison, Sir Stafford Cripps, Mr. Dalton, Mr. Isaacs, and others—the House has not been impressed, and even Labour Members have been critical, a few in the Chamber, and more than a few in the lobbies.

Mr. Wilmot had the general task of defending his youthful Ministry and justifying its continued existence, and while he pointed to useful work by several divisions of the Ministry he gave no very convincing reason why these could not be attached to other Departments. Among other things he gave an account of the Ministry's commissioning of new generating plant. He pointed out that the normal period between ordering power station plant and securing delivery was upwards of two years, and complained that output was still restricted by shortages of materials and labour.

Standardization of Plant

Another delaying factor, the Minister claimed, was that every separate electrical undertaking had ordered plant of its own fancy and design without any regard for the loading of the industry. Some immediate relief had been obtained by repair and maintenance, but the next most urgent requirement was to standardize the production of power plant. Mr. Wilmot affirmed that he had inherited a "completely unstandard situation" and that a very substantial improvement had since been made. The Central Electricity Board had agreed that there should be two standard types, 30,000 and 60,000 kW, of standard steam pressures and temperatures.

It was from the Government benches that there then came the charge that Mr. Wilmot had glossed over this situation very smoothly. The shortage of power, submitted Mr. C. R. Hobson, was far graver than the shortage of fuel; the latter would be solved in a couple of years, but not the former. The power needs of Britain to-day were at least 1,725,000 kW, or the equivalent of fifteen medium power stations. He echoed a general concern when he spoke of the allocation of steel, ferrous and non-ferrous metals to the firms making generating plant, and reminded the House that this was Mr. Wilmot's direct responsibility. Only twelve generating sets had been erected in the last year—a lamentable performance, less than one set for each company capable of making them. Although the directive that generating plant should have top priority had been given by the Cabinet, it had not been carried far enough down, and the manufacturers were experiencing great difficulty in getting steel. What the Ministry was doing about it had not been made clear.

Minister of Labour's Statement

Mr. Isaacs, two days earlier, announced that spreading the industrial electricity load by staggering was to be compulsory, and under a Defence Regulation penalties of £500 or a year's imprisonment could be imposed on recalcitrant firms. No doubt some such legislation is necessary, but it is the view of many Opposition M.P.s that it was wrong to use wartime powers and that there was sufficient time to prepare a short Bill.

What perhaps is a more serious sign of the times is the air, almost of complaint, with which Mr. Isaacs says, "The demand for electricity has risen by 70 per cent since 1939 and is still rising; this creates a very serious problem." How much more serious would the problem be if the industrial demand for electricity had *not* risen, if industry were failing to respond to the call for increased output for export? The truth of the matter is, of course, that if we do not get sufficient coal in the next year or two the outlook will be more serious than most of us have yet realized.

In the debate earlier in the month on the productivity of labour Sir David Maxwell Fyfe made the point that it was impossible to consider productivity without saying something about coal. It was the shortage

of coal that lay at the back of the steel shortage, which in turn delays the building of generating plant. There was practically nothing we could not get were the supply better at the present time.

Another day we were talking about the import programme and in a matter of minutes Mr. Eden was saying the inevitable: "First and foremost comes the question of coal. Shortage of coal is putting a brake upon industrial activity in every sphere." What action did the Government propose to take if the level of coal production continued below our minimum national needs? In his reply, the Lord President made it seem quite likely that we should fail to attain the admittedly inadequate figure of 200 million tons, and thought it quite possible we should have "great dislocations" again during next winter. Yet in the same speech Mr. Herbert Morrison spoke hopefully of "redoubling our efforts to resume coal exports to the Continent at the earliest possible moment."

What prospect there is of that may be judged from the debate on the coal industry itself in the middle of the month. Mr. Shinwell, in a speech more informative and less aggressive than is customary, claimed there were some satisfactory features. There was full co-operation between the miners and the Coal Board, but a heavy responsibility rested on the 10 per cent who for various reasons were not pulling their weight. But the responsibility was not wholly theirs. New coal faces had to be opened up and new machinery installed, and all that took time. That perhaps is the new keyword. We have talked of the shortage of manpower, and of dollars; but at the root of it all is the desperate shortage of time. And as the winter of 1947–48 gets remorselessly nearer, we listen to the plans and proposals of Ministers and wonder whether they will achieve sufficient before it is too late.

NEW BOOKS

Radar Engineering. By Donald G. Fink. Pp. 644; figs. 471; index. McGraw-Hill Publishing Co., Ltd., Aldwych House, London, W.C.2. Price 35s.

Radar engineering is a comparatively new branch of radio engineering which, as "wireless," was itself not long ago regarded as a minor sideline of electrical engineering. Yet this American book, almost the first textbook on the subject, with its 644 closely-packed pages (some of the diagrams perhaps too closely packed) is not excessively diffuse in its treatment. Almost any section of it could be expanded to several times its size by going into known detail. In other words, this work, considerable though it is, forms a serious introduction rather than an exhaustive treatise.

Thus, no knowledge of pulse techniques, television, or microwaves is assumed and a considerable proportion of the space is devoted to basic principles which may not have been given sufficient attention by the radio engineer—pulse theory, transmission lines and waveguides, magnetrons, cathode-ray tubes, beam aerials and the propagation of very short waves. So, although "radar" is dealt with in its strictest sense (excluding related systems, such as respondor beacons and "Gee") and examples of equipment are confined to U.S. Army types, this is by no means a specialists' book, but is useful to all who wish to know about modern radio techniques, such as are being applied in television, navigation aids and communications.

The material is divided into two parts, theoretical principles and typical embodiments of those principles; it is on the whole well balanced and organized and clearly expounded. As might be expected in a work of such size so soon after the release of information, there are a few errors and obscurities. The most serious of these, strangely enough, are in the most elementary sections, especially in relation to circuit theory. Provided that the reader is well enough grounded in electrical principles not to be misled by Sections 35-37, devoted to the behaviour of simple combinations of L, C and R to current and voltage pulses, he will find this book a comprehensive and comprehensible guide.—M.G.S.

Books Received

Plastics for Electrical and Radio Engineers. (2nd edition.) By W. J. Tucker and R. S. Roberts. Pp. 167; figs. 28; index. The Technical Press, Ltd., Gloucester Road, Kingston Hill, Surrey. Price 15s.

The Metallization of Plastics. By J. R. I. Hepburn. Pp. 71; figs. and illus. Cleaver-Hume Press, Ltd., 42a, South Audley Street, London, W.1. Price 6s.

Telegraph Transmission Theory. By E. H. Jolley. Pp. 124; figs. 53. Sir Isaac Pitman & Sons, Ltd., 39, Parker Street, London, W.C.2. Price 7s. 6d.

Materials-Handling Equipment. By M. W. Potts. Pp. 172; illus. and index. Sir Isaac Pitman & Sons, Ltd.

Fundamental Principles and Applications of Induction Heating. By "Heat-Treater." Pp. 145; figs. 104; index. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 10s. 6d.

Overseas Electrical Trade

Exports Up Again in June

APPARENTLY the Government's restriction of exports of generating plant is not yet having such a marked effect as the Board of Trade returns for May seemed to indicate. The June figures just published are almost double those for May, £679,744 compared with £361,269, the whole of the increase being accounted for by greater shipments of machines of over 200 kW (£437,840 as against £118,142 in May). Compared with June, 1946, and with the monthly average for 1938 the total generator exports have been roughly quadrupled. In considering these figures it must not be overlooked that large generators are costly pieces of equipment and a very few sent abroad in a particular month will have a conspicuous effect on the total; also many of the orders were placed long before the fuel crisis fully brought home the seriousness of the shortage of generating plant in this country. By far the greatest customers for generating plant were South Africa (£246,320) and Russia (£195,346).

Electrical exports as a whole at £5,685,315 are £385,215 up on the May figure and no less than £2,128,713 more than in June, 1946. They are about three times what they

Table I.—Electrical Exports and Imports

Class	Exports			Imports		
	June, 1947	June, 1946	Monthly Av., 1938	June, 1947	June, 1946	Monthly Av., 1938
	£	£	£	£	£	£
Telegraph and telephone wires and cables, submarine	38,848	29,104	17,289			
Ditto, not submarine	199,282	125,815	71,803			
Wires and cables, other than telegraph and telephone, rubber insulated	355,601	198,123	117,533	3,863	2,163	31,246
Ditto, insulation other than rubber	437,950	331,008	153,256			
Commercial radio apparatus	104,687	66,294	28,296	*	*	*
Domestic radio receivers	377,297	246,685	36,755	430	7,551	10,148
Telegraph, telephone and signalling apparatus	†401,159	312,212	242,716	8,428	1,240	9243
Other radio, etc., apparatus	235,211	247,345	57,848	9,705	391,382	47,870
Valves	120,186	200,332	41,272	39,461	2,871	10,893
Electric carbons, furnace	*	*	*	37,905	—	4,054
Other electric carbons	*	*	*	3,985	4,207	2,301
Electric lamps	103,359	81,660	49,440	3,888	1,119	10,265
Other lighting apparatus	247,579	134,089	48,565	3,781	2,644	38,662
Primary batteries	31,283	31,972	13,572	2,550	2,094	3,549
Accumulators, portable	159,781	91,290	28,874	*	*	*
Ditto, stationary	16,288	20,868	19,773	*	*	*
Ditto, parts and accessories	28,965	38,546	—	*	*	*
Electric cooking and heating apparatus	236,382	77,703	30,664	*	*	*
Commercial electrical instruments, including ammeters, voltmeters, etc., and parts	77,948	52,621	15,878			
House service meters	58,035	28,596	15,791	33,782	5,927	32,057
Other electrical instruments	71,030	41,648	9,612			
Electro-medical apparatus other than X-ray	26,896	13,922	3,038	*	*	*
X-ray apparatus, vacuum tubes and parts	38,595	16,382	4,881	19,824	9,188	9,734
Insulating materials, not elsewhere specified	121,837	81,715	19,343	*	*	*
Unclassified electrical goods and apparatus	277,534	200,603	108,083	15,120	22,102	52,980
Generators, complete, up to 200 kW	113,396	32,704	38,071	*	*	*
Ditto, over 200 kW	437,840	71,108	119,079	*	*	*
Ditto, parts	128,508	70,847	—	*	*	*
Railway and tramway motors	25,714	24,278	15,977			
Other motors up to ½ h.p.	32,510	24,117	9,001			
Ditto, over ½ h.p. but under 1 h.p.	25,964	7,783	2,470	15,098	574	26,033
Ditto, 1-250 h.p.	217,886	124,811	96,637			
Ditto, over 250 h.p.	2,822	6,781	20,960			
Converting machinery	2,735	625	101,304	*	*	*
Transformers including coils	268,520	134,073				
Rectifiers for power house use	7,702	8,691	3,463	*	*	*
Motor starting and controlling gear	93,204	60,668	50,866	*	*	*
Switchgear and switchboards, other than telegraph or telephone	293,083	210,132	184,533	*	*	*
Other electrical machinery	13,665	8,509	15,497	55,089	1,026	14,455
Electric vacuum cleaners and parts	235,738	70,660	26,662	*	*	*
Other electrically-operated portable appliances	20,295	32,282	10,394	1,463	1,461	24,627
Total	5,685,315	3,556,602	1,829,198	254,372	455,549	328,117

* Not classified separately. † The figures for 1947 are not completely comparable with those for previous years.

were before the war. Goods and apparatus exports alone totalled £3,765,733, as compared with £2,668,533 in the corresponding month of last year and with £1,134,284 for the monthly average for 1938. The largest buyers were the Empire countries, South Africa (£569,787), British India (£340,891), New Zealand (£192,852) and Australia (£184,401), with Norway (£166,996) next.

Table II.—Distribution of Exports of Electrical Goods and Apparatus

Destination	June, 1947	June, 1946	Monthly Av., 1938
	£	£	£
Eire	174,081	84,351	37,726
Channel Islands	38,592	40,408	12,177
Palestine	133,061	122,724	8,426
British West Africa	46,530	51,708	12,889
Union of South Africa	569,787	236,804	162,584
Southern Rhodesia	69,450	29,354	9,632
British East Africa	62,037	22,578	7,893
British India	340,891	277,105	123,789
Burma	44,879	818	5,337
British Malaya	165,734	72,122	32,792
Ceylon	20,829	14,745	15,048
Hong Kong	48,704	41,584	12,939
Australia	184,401	104,236	197,366
New Zealand	192,852	106,327	96,225
Canada	44,532	24,290	12,547
British West Indies	31,916	32,324	12,954
Other British Countries	80,513	36,155	21,265
Soviet Union	8,446	5,928	36,781
Finland	16,332	14,346	5,969
Sweden	122,596	117,712	14,948
Norway	166,996	89,924	12,881
Iceland	8,293	27,089	2,796
Denmark	97,593	54,295	18,907
Poland	20,751	5,308	9,702
Netherlands	84,838	141,360	22,010
Belgium	104,479	65,093	11,208
France	18,967	190,426	16,082
Switzerland	25,586	9,934	3,768
Portugal	54,290	124,088	6,512
Spain	79,291	12,596	3,813
Czechoslovakia	20,630	10,627	7,256
Yugoslavia	30,228	1,227	1,475
Greece	22,068	25,934	4,926
Turkey	67,216	18,108	7,684
Portuguese East Africa	19,562	2,623	6,942
Egypt	85,524	139,748	13,176
Iraq	53,525	15,749	5,530
Iran	60,991	15,932	16,345
China	40,650	7,591	4,119
United States of America	8,439	5,402	5,839
Mexico	20,189	5,445	1,466
Venezuela	37,931	75,955	2,936
Chile	18,753	2,909	6,635
Brazil	37,047	22,493	11,164
Argentine Republic	87,500	59,803	45,452
Other Foreign Countries	98,234	103,255	46,371
Total	3,765,733	2,668,533	1,134,284

Cable exports are generally higher than in May and though domestic radio receivers at £377,297 are £54,172 lower they show a great advance on the figures for June, 1946 (£246,865). The largest purchaser of radio sets was Palestine (£55,761), followed closely by South Africa (£53,085) and British India (£50,755). Exports of telegraph, telephone and signalling apparatus (£401,159) were £118,047 lower than in May, South Africa taking £102,928 worth.

The popularity of British heating and cooking apparatus continues and at £236,382 exports are roughly eight times their pre-war figure. Over four times as many vacuum cleaners are now being exported than before the war and their value is nine times as much.

The recent tendency of imports of electrical equipment to rise was continued in June with a total of £254,272, which is £8,495 above the May figure, though well below that for June last year (£545,551) and the monthly average for 1938 (£328,117). Most of the electrical goods and apparatus again came from the United States (£93,019 out of £182,722), with Canada supplying £34,329 worth and Switzerland £9,327 worth.

French Electrical Trade

THE official statistics of French foreign trade for 1946 give a fair amount of detail of the electrical side. From them have been extracted the following principal items of imports, with the leading suppliers of a few groups. France last year was an exporter to a greater extent than an importer of switch and control gear, telegraph and telephone (including radio) apparatus, and heating material. The reverse was the case in dynamo-electric machines and transformers.

Class of Goods	1946 Fr. (000)
Dynamo-electric machines and transformers	500,000
From Germany	53,000
„ Great Britain	116,000
„ Switzerland	120,000
„ United States	145,000
Switch and control apparatus	163,000
From Switzerland	68,000
„ Great Britain	20,000
„ United States	27,000
Electric welding apparatus	74,000
Telegraph and telephone apparatus	19,000
Automatic telegraph apparatus	22,000
Radio apparatus except valves imported separately	61,000
From Germany	33,000
„ United States	22,000
Measuring apparatus except meters	15,000
Electro-medical apparatus	33,000
Electric heating material	34,000
From Germany	12,000
„ United States	14,000
Domestic refrigerators (elec.)	10,000
Unspecified electrical apparatus	51,000

The leading electrical items exported (valued in thousands of francs) were:—Dynamo-electric machines and transformers, to Colonies 174,000, foreign countries, 72,000; switch and control apparatus to Colonies, 144,000, to foreign countries, 90,000; telegraph and telephone apparatus, to Colonies, 41,000, to foreign countries, 10,000; radio apparatus, to Colonies, 202,000, to foreign countries, 85,000; heating apparatus, to Colonies, 76,300, to foreign countries, 19,000; and domestic apparatus, 44,000 to Colonies, to foreign countries, 48,000.

COMMERCE and INDUSTRY

Next Year's B.I.F. Payment for Bank Holidays.

THE British Industries Fair, 1948, will be held in London and Birmingham from May 3rd to 14th. Forms of application for exhibition space will shortly be sent to manufacturers known to be interested in the Fair. On receipt of the application form, intending exhibitors are urged to notify promptly their requirements in order to facilitate the early allotment of space.

Cowal Scheme Contracts

The North of Scotland Hydro-Electric Board has placed the main contracts for the Cowal Constructional Scheme. This project is designed to supply the electricity demands of consumers in the Cowal district of Argyllshire and the Islands of Bute and Cumbrae. Crowley Russell & Co., Ltd., Glasgow, have been given the contract for the major part of the civil engineering work covering the construction of the Glen Tarsan and Glen Lean dams, the main tunnel, aqueducts and road diversion. The Harland Engineering Co., Ltd., Alloa, is to supply and erect the water turbines and electric generators of the Loch Striven generating station. This plant will consist of two 3,000-kW alternators, direct coupled to Harland "Morgan-Smith" Francis type water turbines of 4,250 h.p. The normal speed of the turbines will be 600 r.p.m., and they will operate at a gross head of 400 ft. The Glen Tarsan dam will have an overall length of 1,046 ft.

Electronic Apparatus Display

A two-day exhibition of electronic devices and instruments, chiefly Siemens, Metropolitan-Vickers, Mullard, G.E.C., B.T.H., W. Edwards, Cossor, Ferranti and Chloride products, recently held in the College of Technology, Manchester, was the second annual display of its kind to be organized by the North-Western branch of the Institution of Electronics.

Municipal Radio Sales

Oldham Electricity Committee has postponed a decision on a proposal to purchase 200 radio sets for sale to the public. A sample receiver was recently demonstrated to the members of the Committee. The sets are estimated to cost £3,533, the profit on their sale being £696. A scheme has been put forward for a number of local authorities to join together to order 5,000 sets to be sold to ratepayers in their respective districts. There was criticism at the Oldham Electricity Committee meeting because it was not made clear if there would be any overhead charges and whether personnel would have to be engaged to service the sets.

Newcastle Design Week

During the recent Newcastle Design Week organized by the Council of Industrial Design in co-operation with the Federation of British Industries and the Newcastle Chamber of Commerce, the North Eastern Electric Supply Co., Ltd., arranged a special exhibition of modern electrical domestic appliances at its showrooms, Carliol House, Newcastle-on-Tyne. A section of this display is shown in the accompanying illustration.

North Eastern Electric Supply Co.'s display during the recent Newcastle Design Week

Holidays in the Contracting Industry

Starting with August Bank Holiday, payment at bare time rates is to be made in the electrical contracting industry for statutory and other holidays (up to six per annum) on which no work is performed. Scheduled days are Good Friday, Easter Monday, Whit Monday, August Bank Holiday and Boxing Day, but these only become paid holidays in areas where they are normally observed as holidays in the contracting industry. Provision is made for traditional

local holidays to be observed in substitution when ratified by the N.J.I.C. (all local holidays except those so ratified are to be cancelled). There is a proviso making it necessary to work on the working day before and after the holiday, but this may be waived in exceptional circumstances. When called upon to work on Christmas Day an employee is to be paid double time and also given a day off with pay in lieu. For other holidays covered time-and-a-half may be paid plus a day off, or two-and-a-half times ordinary rates with no day off.

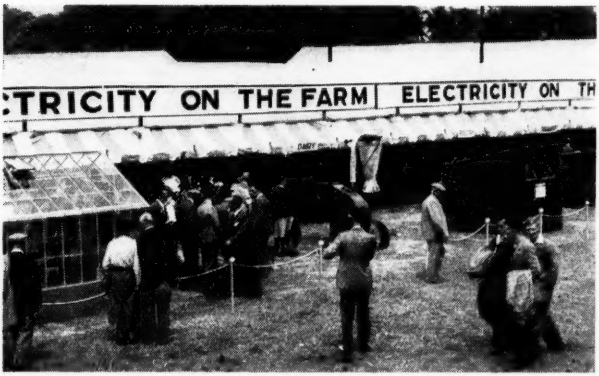
B.E.A.M.A. Contract Price Formulæ

Discussions are proceeding between the British Electrical and Allied Manufacturers' Association and representative purchasing bodies regarding changes in the factors used in the contract price adjustment clause and formulae. In the meantime manufacturers are advised to insert a "safeguarding" clause in tenders providing that any revisions made before plant is dispatched or ready for commercial use (in the case of contracts including erection) shall be applicable to the contracts.

Agricultural Shows

The S.W. & S. Electric Power Co.'s stand at the Three Counties Show, Hereford, attracted many visitors. As was to be expected, a good deal of the exhibition was devoted to agricultural applications of electricity. Among the appliances for dairy farming there was the new Woolley Whizzer sterilising chest which recently won the silver medal at the Royal Lincoln Show. Milk cooling also had its place among a group of representative commercial refrigerators, all manufactured by the International Refrigerator Co. Another exhibit of note was the electric hoist, manufactured by W. G. King & Co., Ltd. Of interest to the majority of rural dwellers was the range of water pumps by James Beresford & Son, Ltd. The Power Co. had on show a comprehensive display of domestic appliances. A full range of cookers, water heaters and washing machines was displayed, and the special steriliser manufactured by the Yeovil Sheet Metal Co. proved a popular feature.

Electricity on the farm was demonstrated on the largest stand at both the Kent and Sussex Agricultural Shows held in Maidstone on July 9th and 10th, and in Chichester on the 16th and 17th. The exhibit was divided into sections which covered horticulture, the home, the dairy, poultry, general farming, transport (electric vehicles), the workshop and installations. The planning and organizing were carried out by the South East & East England E.D.A. Area staff, in conjunction with co-operating members of the Southern Committee in both counties. The whole of the exhibits were moved from Maidstone between July 10th and 16th and set up again in Chichester, a total of 140 exhibits being involved. Nine lorries were required to move the equipment. On the first day of the Kent Show, the electrical stand was visited by the Duchess of Kent, who was escorted round the stand by Mr. E. E. Hoadley. The electrical exhibit was widely advertised in local papers throughout Kent and Sussex through the generosity of undertakings in giving up their regular advertising space for the purpose, and a special feature was the advance wide circulation of a leaflet containing a description of the exhibits to farmers throughout both counties.



E.D.A. stand at the Kent and Sussex shows

The caterers at the Kent Show were persuaded to undertake all-electric cooking which gave excellent publicity for large scale electric cookery, E.D.A. equipment being lent for the purpose.

Action Against Electrician

William Campbell, electrician, of Dundee, recently pleaded not guilty to having "wilfully injured or suffered to be injured a pipe, meter, or fitting, the property of the Corporation, by cutting the live lead between the Corporation fuse box and the terminal board of the Corporation meter."

An installation inspector employed by the Corporation said respondent requested him to cut off the supply of electricity because of non-payment of the account for wiring. He could not do that without authority. Later Campbell told him he had cut the wire. Another Corporation official said the wire from the main switch, left by the contractor, definitely belonged to the Corporation.

Respondent admitted cutting the wire which he considered to be his own. The tenant had not paid him till after he had cut it. His solicitor argued that the statute did not mention the cutting as being an offence. The question was whether the wire belonged to the Corporation or to somebody else. It belonged to the tenant if it had been paid for. He submitted there was no case.

The Magistrate, in his decision, said the wire was there as a right of way for the Corporation to supply electricity. To that extent Mr. Campbell had done wrong. He found him guilty but dismissed him. Respondent's solicitor claimed that that was not a decision, and that there was no conviction. He was told by the Magistrate he could appeal to a higher Court and the solicitor said he would ask for a stated case.

Reports on German and Japanese Industry

Recent reports on German and Japanese industry, obtainable from H.M. Stationery Office, include the following:—B.I.O.S. 1389, "Design and Production of Counting Instruments (Electrical) (3s.). B.I.O.S./JAP/PR/651/2/3, "Japan's Power Plants and their Equipment," Part A, Thermal Power Plants, with Appendices I and II (19s.). B.I.O.S./JAP/PR/654/5, "Japan's Power Plants and Equipment," Part A, Thermal Power Plants, Appendices III and IV (20s.).

Heenan & Froude Acquisition

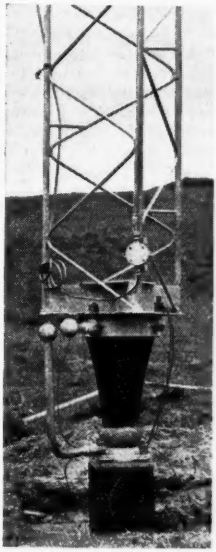
The whole of the shares in W. G. Bagnall Ltd., locomotive designers and builders, Stafford, have been acquired by Heenan & Froude, Ltd., Worcester, from Mr. J. Cadman, chairman of Bagnall's and a director of the National Provincial Bank. The new board of directors of Bagnall's will be:—Chairman, Mr. A. P. Good; directors, Mr. James Fielding, the Hon. A. C. Geddes, Mr. I. A. Marriott, and Mr. Charles Hill; secretary, Mr. W. O. J. Urry.

Heat-Controlled Electric Iron Chart

As the tenth of its series of "How It Works" coloured wall charts, the Electrical Association for Women has issued one dealing with the heat-controlled electric iron. It illustrates a cut-out section of the iron showing the thermostat which controls the heat temperature. The chart measures 19½ in. by 30 in., is linen backed and varnished, metal stripped top and bottom, and is suitable for wall hanging. The price is 4s. 6d. post free.

Maintenance Masts for B.B.C.

In order to allow major maintenance works to be carried out on the B.B.C. permanent mast-oscillators, the Corporation recently decided to purchase two light section masts capable of being dismantled, transported and quickly erected 1,000 ft. distant from the permanent masts. These temporary mast-oscillators radiate the signals whilst the repair and maintenance work is in progress on the permanent structures. The specification called for 300 ft. masts triangular in section, with parallel sides, insulated for a peak working voltage of 20 kV r.m.s. The mast had to be designed to withstand a wind load of 27 lb/sq ft at ground level rising to 30 lb/sq ft at 300 ft level. This wind load was to be assumed to act on 1½ times the area of one exposed face. The order for the design, supply and erection was placed with J. L. Eve Construction Co., Ltd. The legs and bracings are of round mild steel rod with connection arc welded. The mast was made up of 18 sections each 16 ft 8 in. long which were bolted together by flange plates. All the steelwork was hot dip galvanized. The base insulator was a Lapp conical insulator with rocker and the stays were fitted with Doulton egg insulators. The total weight of each mast including all stays, insulators, foundation blocks, lighting cable and all sundry fittings was 4½ tons.



One of the B.B.C. temporary mast-oscillators erected by the J. L. Eve Construction Co., Ltd.

The order was placed in June, 1946, and the masts were designed and manufactured within nine months.

London Domestic Science School

The annual presentation of diplomas was held at the London School of Electrical Domestic Science, Imperial Court, Basil Street, London, S.W.1, on July 25th when Mrs. Beatrice Wright, a former M.P. for S.E. Cornwall, presented the certificates to the successful students. Mrs. Wright was introduced by Mr. S. C. Hurry, chairman of directors, and in a brief speech she stressed the importance of training in the art of salesmanship and spoke of some of the qualities which went to make a good salesman. In the sphere of domestic electrical appliances she considered that women, who understood the housewife's needs, were better qualified to spread the electrical idea than men. Mrs. V. Bain, the principal of the School, mentioned

that of thirty-eight who sat for the examinations, thirty-five had obtained diplomas. She read a message from Miss H. M. M. Minoprio, who was on the Continent, wishing students good luck in their future careers.

Littlebrook "A" Power Station

Referring to the description of the Littlebrook "A" power station which appeared in the *Electrical Review* of July 25th, we would like to add that the 73,000-kVA transformer and the two 45,000-kVA transformers mentioned were supplied by the Fuller Electrical & Manufacturing Co., Ltd. The two 45,000-kVA transformers are equipped for on-load tap changing.

Fatal Shock from Drill

George Barker (aged thirty), employed by William Kenyon & Sons, sub-contractors, was drilling a sheet of metal at Meaford power station when he received an electric shock and collapsed. Artificial respiration was applied by an ambulance attendant without success. At the inquest a verdict was recorded that death was due to "respiratory paralysis following an electric shock accidentally sustained while at work with a portable electric drill the earth continuity wire of which had broken."

Machine Tool Trades Exhibition

The Machine Tool Trades Association will stage an international exhibition at Olympia, London, late in August, 1948. It will be called the Machine Tool and Engineering Exhibition London, 1948. This will be the first exhibition of its kind to be held in London since the M.T.T.A. Exhibition at Olympia of 1934.

Football by Floodlight

Edinburgh Corporation public football pitches may be floodlighted to permit play on six nights a week. The manager of the Lighting Department suggests the erection at a cost of £650 of six 35-ft-high standards for illuminating each pitch and he is preparing estimates.

Trade Publications

A.E.W., Ltd., High Street, Edgware, Middx.—Illustrated and priced leaflets on "Klipin" miniature circuit breaker and combination breaker and plug-socket.

Frank Whitelegg, 90, Robin Hood Lane, Sutton, Surrey.—List (GNC) illustrating wire winding and working machines and accessories.

Howard Clayton-Wright, Ltd., Tiddington Road, Stratford-on-Avon.—Illustrated leaflets on renewable rubber-headed mallets.

John Vessey & Sons, Ltd., Denby Street, Sheffield, 2.—Bound brochure on crucible cast steel, a short monograph in simple language.

Mond Nickel Co., Ltd., Grosvenor House, Park Lane, W.1.—Well-produced brochure entitled "Nickel in the R.M.S. *Queen Elizabeth*" illustrating the versatility of this metal and its alloys in marine engineering, relative to the propulsion machinery, pumps, electrical equipment, navigational and safety equipment, catering equipment, sanitary fittings, interior decoration and lighting fittings.

Multicore Solders, Ltd., 23, Albemarle Street, London, W.1.—Testing sample card of three-core solder; also folder illustrating processing details with tabulated data and sections printed in French and Spanish.

Dissolution of Partnership

Messrs. R. G. Clare and W. J. Indoe, carrying on business as electrical and radio engineers at 3, Coburg Place, Widcombe, Bath, as Clare & Indoe, have dissolved partnership. Mr. Indoe will attend to debts and carry on the business in his own name.

Trade Announcements

Auto Service Garage, Ltd., Bournemouth, has been appointed distributor for Dorset, South Wiltshire and South Somerset for "Brush-Bred" battery electric vehicles, and Nicholl & Sons, of Bedford, have been appointed distributors for the counties of Bedford, Huntingdon and Northampton.

The telephone number of Electrical Wholesale Supply Co. (Leicester), Ltd., 17, Highcross Street, Leicester, has been changed to Leicester 22589.

The address of the Midlands branch office of Clough, Smith & Co., Ltd., is now Broad Street Wharf, Wolverhampton (telephone No. 20133).

Selecta Gramophones, Ltd., is moving on August 5th to 50, Southwark Bridge Road, London, S.E.1 (telephone: Waterloo 7601).

The telephone number of Whipp & Bourne, Ltd., at their temporary accommodation in Room 8, 2nd Floor, 66, Victoria Street, London, S.W.1, is Victoria 7106.

Annual Holidays

The works of the Micramatic Electrical Instrument Co., Ltd., will be closed from August 15th until August 25th, for the annual holidays.

Change of Name

Challis & Loveys, Ltd., have changed their name to Gardner & Loveys, Ltd.

Trade Marks

THE following application has been made for the registration of a trade mark. Objections may be entered within a month from July 23rd.

MINDUS. No. 647,842. Class 7. Electric motors (not for land vehicles).—Midland Industries, Ltd., Heath Town Works, Deans Road, Wolverhampton. To be associated with No. 647,943 (3612) xi.

ELECTRICITY SUPPLY

Accident at Clarence Dock. Expediting New Poplar Station.

Gravesend.—EXTENSION SCHEMES.—A scheme submitted to the Electricity Commissioners for approval provides for the erection of overhead lines which will give a supply to every occupied building in the rural area. Application is also being made for a Fringe Order to supply premises outside the area, and for sanction to a loan of £72,000 for distribution equipment for housing estates.

Hawick.—REDUCED CHARGES.—Referring to the note published in our July 11th issue relating to reduced charges, we are informed that the heating and cooking rate is 1½d. per kWh. The reduction from 1d. to ¾d. refers to the " unit " charge under the two-part tariff.

Liverpool.—FAILURE OF SUPPLY.—With regard to the failure of supply at Clarence Dock power station at about 2.30 p.m. on July 23rd, Mr. J. Eccles, the city electrical engineer, informs us that No. 2 reactor in the switch house of No. 1 station had been isolated and earthed in a normal manner so that cleaning work could be carried out. Two men were detailed to clean the insulators in the cubicle and for this purpose were using a portable vacuum cleaner. It would appear that an arc occurred in an adjacent cubicle, which caused severe electric burns to one of the men, resulting in his death. The other man, who was working near him, received slight burns on his right arm. The accident resulted in the complete isolation of Clarence Dock from the undertaking's electrical system and from the Central Electricity Board. Lister Drive generating station had to open feeders in order to restrict the load to the amount of plant available. The affected area of the switch house was isolated and a small resulting fire was extinguished. Supplies were again available from the station at 3.15 p.m. and all consumers were reconnected at 5.20 p.m.

Macclesfield.—STREET LIGHTING.—The Lighting Committee proposes to provide electric lighting along part of the existing trunk road from the borough boundary at a cost of £7,904.

Margate and Broadstairs.—CHANGE-OVER.—The Margate and Broadstairs Electricity Board has applied to the Electricity Commissioners for consent to change from d.c. to a.c. This is the first step in a plan which may take ten years to complete, depending on the supply of materials.

Plymouth.—REDUCTION OF SURCHARGE.—It is proposed to reduce the 20 per cent addition to electricity consumers' accounts to 15 per cent.

LOAN FOR POWER STATION EXTENSION.—Sanction has been given to the Council's application for permission to borrow £2,500,000 for the extension of the Prince Rock generating station.

Poplar.—NEW POWER STATION.—The Electricity Committee reported to the Council on Monday last that a communication had been received from the Electricity Commissioners concerning the erection of the Poplar generating station. Referring to the Government's statement that precedence must be given to projects for increasing fuel and power resources, the Commissioners asked that they should be notified of any case where it appeared that full regard was not being paid to that decision. The Council then accepted four tenders for work in connection with the station totalling over £1,364,000 (£228,000 for coal handling plant, £316,000 for construction of a wharf pump house, £340,000 for ash and dust handling plant and £480,000 for pipe-work).

Rotherham.—FACTORY SUPPLY.—A supply of electricity to works in Fullerton Road will cost £2,500 for cables and switchgear.

Stockton-on-Tees.—COMPLETION OF CHANGE-OVER.—The general manager and engineer (Mr. N. Hunter) has recommended that an effort should be made to complete the change-over, which was started as far back as 1930. Only fifty-three consumers remain on the d.c. system, but as the most expensive change-overs have been left in abeyance since the beginning of the war the cost of completing the work is estimated at £11,620.

EAGLESCLIFFE REINFORCEMENT.—Owing to the increasing demand in the Eaglescliffe area reinforcement of the supply is necessary, including the provision of a new 11-kV feeder. The total estimated cost is £28,105.

Workington.—EXTENSIONS.—Application is to be made by the Electricity Committee for sanction to borrow £2,250 for supplying electricity to a section of Westfield estate and £1,550 for supplying 150 permanent houses on the Salterbeck estate.

Overseas

Belgian Congo.—POWER FOR COPPER PRODUCTION.—At a recent annual meeting in Brussels of the Union Minière du Haut Katanga, the largest copper and zinc producing undertaking in the Belgian Congo. The chairman reported that owing to the shortage of water supplies, the output of the Cornet Falls hydro-electric station belonging to the Société Générale des Forces Hydro-electriques du Katanga during 1946 amounted to only 224 million kWh compared with nearly 380 million kWh in 1945; this had the effect of reducing the Minière Co.'s production of copper from 160,000 to 144,000 metric tons. In order to provide an increased output of electric power to meet not only its own requirements but also those of other industries

in the Katanga area, the Union Minière has decided to construct two new hydro-electric plants. Work on one of these is already in progress at the Koni Falls on the River Lufira, to be equipped with three sets of 15,000-kW turbines and alternators, one of which will act as a reserve. The second new station will be at Nzilo on the River Lualaba. It is stated that when the two new stations are completed, the Union Minière will have at its disposal about 1,000 million kWh per annum.

Canada. — TORONTO UNDERGROUND - CABLE SCHEME.—A plan to place all overhead lines in the "downtown" district underground is estimated to cost about $26 million of which the Toronto Hydro-Electric System would have to meet approximately $23 million. To remove all the poles and wires from every business section of the city would cost some $125 million.

Mexico.—DROUGHT RESTRICTS OUTPUT.—In the first two weeks of July the quantity of water entering the reservoirs of the Necaxa hydro-electric system was only 65 per cent of the daily average of the driest July on record. The Mexican Light & Power Co. announces that in consequence the Government has imposed severe restrictions on electricity consumption.

Peru.—ANDES POWER PROJECT.—Cheap electric power to speed the industrialization of Peru should be available by summer of 1949, according to an engineering director of the Corporation Peruana del Santa. He reports that the Canon del Pato hydro-electric plant which the corporation is building in the Peruvian Andes is one-third completed; it should be finished by the summer of 1949 if needed deliveries of equipment from the United States are received. The corporation, which is similar in its regional planning to the T.V.A. project, is the first experiment of its kind in Peru, and plans to supply the area as far as the coast some 50 miles away with 100,000 kW.—*Reuter's Trade Service.*

South Africa.—JOHANNESBURG DEVELOPMENTS.—According to a report submitted by Mr. J. C. Fraser, general manager of the Johannesburg Electricity Department, it is anticipated that the Department will spend £2,603,000 on capital works in the period to June 30th, 1950, including £1,618,000 on exten sionsto the Orlando power station. Two 30,000-kW turbo-generators now on order will increase the capacity of the station to 150,000 kW, representing half of the ultimate planned capacity. The first of five new 11,000-kVA transformers ordered twelve months ago nas arrived from Britain and the *South African Electrical Review* comments that the manufacturers have done a fine job in effecting delivery so soon, the normal time in present circumstances being nearer two years.

Switzerland.—ELECTRICITY PRODUCTION EXPANDS.—According to a report by the Banque Cantonale de Berne on industrial activity in Switzerland the total Swiss output of electric power during last year amounted to 8,351 million kWh, as compared with 7,986 million kWh in 1945, an increase of 4·56 per cent. These figures are, however, considerably below those given in a special table included in the 1946 report of the Belgian electricity financing undertaking known as "Sofina," which puts the total output, including that of consumers generating their own requirements, at 10,073 million kWh during the "hydrographic year" ending September 30th last as against 9,600 million kWh in the preceding twelve months. Both the reports state that the ever-increasing demand for power calls for a considerable extension of the existing generating plants and the construction of new dams. It is feared, however, that in view of the existing shortage of materials further periods of restrictions in power supplies may be experienced during the next few years.

TRANSPORT

Austria.—ELECTRIFICATION OF RAILWAYS.—Part of the twelve-year railway electrification programme covering the Attnang-Schladming line is to be completed by the end of 1948. It is then to be continued eastwards and it is expected that the whole route to Vienna will be converted by 1950. The 600 electric locomotives required have already been ordered from Eline, Brown-Boveri, AEG-Union, and the Austrian Siemens-Schuckert works.

Glasgow.—TROLLEY-BUS PLANS.—Because of their greater silence, mobility, lack of obstruction, and the smaller capital cost involved, trolley-buses might eventually take the place of tramcars in Glasgow, but difficulties in effecting the replacement made it likely that it would be a gradual affair, stated Mr. E. R. L. Fitzpayne, Corporation transport manager, in his evidence on July 24th at an inquiry in Glasgow by a Parliamentary Commission into a Provisional Order. The Commission granted powers for the operation of trolley-buses over eight routes.

Sheffield.—FURTHER DEFICIT.—In view of the deficit of £35,804 on the 1945-46 year's working of the Transport Department, application was made for permission to increase fares, and after a public inquiry the application was granted in full. The revision, however, was too late to influence the past year's finances of the undertaking, with the result that there was a deficit of £146,416. During the year (on July 11th) the jubilee of the undertaking was celebrated. The Tramways carried 201·7 million passengers in 1946-47. Electricity consumption per car mile averaged 2·9 kWh.

Sweden.—ELECTRIFIED LINE.—At the beginning of June the State Railways opened traffic on another electrified section of the Central Sweden network, viz., between Västerås and Frövi, a distance of about 50 miles. It is now possible to go by electric train from Stockholm *via* the towns of Västerås, Köping and Arboga to the industrial town of Orebro. The section just electrified was one of the first railway lines built in Sweden about 90 years ago.

FINANCIAL SECTION

Company News. Stock Exchange Activities.

Reports and Dividends

The Electric Construction Co., Ltd., in its accounts for the year ended March 31st last shows a net profit of £58,320, as compared with £89,990 for 1945-46, to which is added £40,339 brought in and £7,500 E.P.T. repayable, making £106,159. After providing £30,000 for taxation, and transferring £9,911 to general reserve and £2,000 to superannuation fund, it is proposed to maintain the dividend on the ordinary stock for the year at 12½ per cent and to carry forward £39,773.

In his statement which accompanies the report and accounts Mr. G. W. Spencer Hawes (chairman) says that the company has suffered considerably from an irregular and insufficient supply of raw materials, particularly of steel, which has not only curtailed the output but has seriously dislocated working operations by prolonging the time normally needed for the completion of contracts. While the present circumstances continue the outlook must remain uncertain. For the present year the volume of output from the works is likely to be still lower and a further decline in profits must be expected.

A. C. Cossor, Ltd.—At the company's meeting last week the chairman (Mr. T. A. Macauley), replying to questions submitted in writing, said that very definite progress had been made in peace-time radar development. He believed that they were well in advance of any of their competitors either at home or abroad. The company's very heavy expenditure on those developments during the year had all been written off. The Sterling Cable Co. had obtained up-to-date American plant which, in association with new British-designed equipment, placed it in a position to produce certain types of cable in constant public demand at the lowest possible price. A separate division for handling plastic insulations was now working efficiently.

Chloride Electrical Storage Co., Ltd.—Referring to production problems at the company's annual meeting the chairman (Mr. A. W. Browne) said that they had been able to assist the local electricity supply company very materially by switching off certain process loading during the daily peak hours and making it up during the night. Regarding the extensive plan to modernize the various works announced the previous year, some progress had been made but there had been considerable delay in obtaining licences. Thereafter there had been delay in getting permits to use the materials required, and in some cases it had been necessary to revise plans completely so as to use alternative materials. Orders from home and abroad continued to be received at a high rate; the value of orders for export exceeded that for any other year in the history of the company. On this point he referred to the difficulties which confronted them in the way of export licences, import permits, currency regulations and shipping space. While a certain number of controls were essential under present-day conditions, it would be a great relief to industry if some of the time spent in filling up forms could be used to better advantage.

After detailing the progress made by subsidiaries, the chairman said that the company had continued to devote close attention to research and technical development. It was intended as soon as circumstances permitted to build a new laboratory for the purpose of carrying out more fundamental research than was possible with existing facilities.

Ward & Goldstone, Ltd., report a profit for the year ended March 31st last of £263,068, as compared with £213,470 for the preceding year, and after providing for depreciation, income tax, E.P.T. and profits tax, etc., there is a net profit for the year of £128,179 (against £54,081), to which is added £84,365 brought in, making £212,544. It is proposed to set aside £30,000 for future taxation and to pay a final ordinary dividend of 30 per cent (actual), less tax (against 20 per cent), making the distribution for the year 50 per cent (against 35 per cent). The balance carried forward is £153,514.

In his review of the year the chairman says that the new premises in the Wigan area have been tooled and equipped and already considerable quantities of electrical accessories have been assembled for Ministerial and export requirements. The volume of exports in the year under review has been about 300 per cent greater than pre-war. The demand for the company's products both at home and overseas continues to be considerable and given adequate fuel, power and raw materials, the outlook would appear to be favourable.

Associated British Engineering, Ltd., reports a net revenue for the year ended March 31st last of £48,997, as compared with £23,630 for 1945-46, to which is added £8,587 brought in, making £57,584. It is again proposed to pay an ordinary dividend of 12 per cent (actual), less tax, for the year, to place £20,000 to dividend equalization account, and to carry forward £18,933.

Cawnpore Electric Supply Corporation, Ltd.—Mr. K. A. Scott-Moncrieff (chairman) stated at the annual meeting that the Government of the United Provinces had notified the corporation that it would acquire its undertaking on September 15th this year. The past year's operations had been affected by strikes and the total kWh sold was about 3¾ per cent less than

in 1945. The employees had put forward certain demands to which the corporation could not agree and the Government appointed an adjudicator. The effect of his award was that the employees were to receive 50 per cent of the value of all the corporation's reserve funds, after meeting liabilities which were not clearly defined. The legality of such an award was open to question and the board would take all possible steps to have it revoked.

The Palestine Electric Corporation, Ltd., announces a net profit of £P.158,067 for 1946, against £P.131,383 for 1945, after meeting taxation and deferred maintenance charges and placing £130,000 (against £75,000) to general reserve. The dividends on the ordinary and "A" shares are maintained at 7 per cent, free of tax, and £132,665 (£119,222) is carried forward. A statement by the chairman says that since the last issue of capital was made (in 1937) nearly £2,000,000 has been expended on capital account and at the end of last year the amount expended was almost double the corporation's issued and paid-up capital. Further outlay will be necessary on the extension of the Reading power station and consideration is being given to the best means of securing finance for that purpose.

Parmiter, Hope & Sugden, Ltd., report a trading profit for the year ended March 31st last of £48,369, as compared with £33,952 for the preceding year, and a net profit of £17,990 (against £10,060). It is proposed to pay a dividend for the year on the £53,710 ordinary capital of 30 per cent, less tax. This compares with a dividend of 25 per cent and a bonus of 25 per cent in the previous year on issued ordinary capital of £3,710.

The Telephone Manufacturing Co., Ltd., reports a net profit for 1946 of £21,783, as compared with £272,495 for 1945. The latter figure was subject to E.P.T. assessment of approximately £200,000. The E.P.T. recoverable for 1946 will be approximately £34,000. The final dividend is 6¼ per cent, maintaining the distribution for the year at 9 per cent.

Aron Electricity Meter, Ltd., reports a net profit for the year to March 31st last, before taxation, of £44,759, as compared with £29,105 for 1945-46. Taxation requires £25,937, general reserve receives £5,000 and the ordinary dividend for the year is 15 per cent (against 10 per cent), leaving £23,244 to be carried forward (against £21,957 brought in).

Peto Scott Electrical Instruments, Ltd., reports a net profit for the year ended March 31st last of £9,169, as compared with £7,554 for the preceding year. The dividend for the year is unchanged at 25 per cent and £13,433 (£10,451) is carried forward.

Newman & Watson, Ltd., are increasing their ordinary dividend from 5 to 6 per cent. The net profit for the year was £15,110 (against £10,949).

Ericsson Telephones, Ltd.—The Ocean Trust announces that it is arranging to underwrite an issue of £1,000,000 3¼ per cent 1965-75 first mortgage debenture stock of Ericsson Telephones at par.

Telephone Rentals, Ltd., proposes to pay a final dividend of 6 per cent (same), making 10 per cent for the year (unchanged).

The Telephone Manufacturing Co., Ltd., has announced a final dividend of 6¼ per cent (same), maintaining the distribution for the year at 9 per cent.

Telephone Properties, Ltd., reports a net profit for 1946 of £34,320, as compared with £29,935 for 1945. The dividend for the year is unchanged at 6 per cent.

Mather & Platt, Ltd., are again paying an interim dividend of 4 per cent.

E. K. Cole, Ltd., are again paying an interim dividend of 8 per cent, less tax.

The Yorkshire Electric Power Co. has declared an unchanged interim dividend of 3 per cent.

Electrical Distribution of Yorkshire, Ltd., has announced an interim dividend of 4½ per cent (unchanged).

The Metropolitan Electric Supply Co., Ltd., is paying an interim dividend of 3 per cent (same).

New Companies

Garwood Patents, Ltd.—Registered June 14th. Capital, £1,000. To deal in patents and inventions and to carry on business of electrical engineers and contractors, designers, etc. Directors: T. A. Garness, T. G. Good, and A. Pearson. Regd. office: Burnett Avenue, Scale Lane, Hull.

Tayler & Matheson, Ltd.—Registered June 10th. Capital, £100. Electrical engineers, etc. Directors: J. Graham-Matheson and K. A. Tayler. Regd. office: "Sidcot," Charlton Lane, Brentry, Bristol.

Fort Electric Engineering Co., Ltd.—Registered June 4th. Capital, £100. R. Fortgang is the first director. Regd. office: 66, Crediton Hill, N.W.6.

Increases of Capital

Marconi Instruments, Ltd.—Capital increased by £200,000 beyond the registered capital of £50,000.

Bastian & Allen, Ltd.—Capital increased by £41,500 beyond the registered capital of £5,000.

Bankruptcies

O. P. Lowther, St. Gildas, Brookway, Friars Cliff, near Christchurch, Hants, formerly 27, Beaufort Mansions, Beaufort Street, London, S.W.3, electrical engineer.—Last day for receiving proofs for dividend August 6th. Trustee, Mr. T. J. M. McLeod, 4, Bucklersbury, London, E.C.4.

STOCKS AND SHARES

STOCK Exchange markets have fallen into a somewhat lethargic and lack-lustre condition, due to the uncertainties of the outlook, political and financial, and to the slump in the prices of British Government securities. The latter factor has introduced further uneasiness into a situation which previously was none too settled. Government intervention would have a quick and tonic effect upon the prices of gilt-edged securities, but the Government has shown little disposition to support its own markets.

New issues, however, continue to be subscribed freely, although resultant premiums have been in some cases conspicuously small. Of the North of Scotland Hydro-Electric issue of 2½ per cent at 100, 29 per cent was left in the hands of underwriters. The Board stated that £3¼ millions out of the offer of £5 millions was provided by a considerable number of subscribers, almost all from Scotland. The inference is that those who put up the money for this 2½ per cent stock at 100 were not acquainted with the prices at which similar securities, with equally good backing, could have been obtained in the London Stock Exchange markets. The price of the stock, according to the Official List of the Edinburgh Stock Exchange, is now about 96.

G.E.C. Accounts

On a yield basis of £3 14s. 9d. per cent, General Electric £1 shares give a return appreciably better than is the case with some of the other leaders in the same market. Reasons for the discrepancy are not apparent in the annual report, which presents, for the first time, consolidated accounts of the group as a whole. These disclose the 17½ per cent dividend to have been paid from group earnings equivalent to about 35 per cent on the parent company's ordinary capital. The latter is shown by the consolidated balance sheet to be covered by general reserves and individual profits with £1 million to spare, while net liquid assets total over £10 millions. The accounts, together with the review of activities, made a favourable impression in the market, but the price eased off to 93s. 9d. cum dividend, in sympathy with the dullness of industrials generally.

Electrical Dividends

Industrial markets are not so apathetic as to allow good results from individual companies to go unrecognized. Both Revo Electric and Aron Electricity Meter shares have been in demand since the declaration of the dividends about a fortnight ago. Arons have moved up from 57s. to 60s. cum dividend, since the restoration of the dividend to 15 per cent. Last year's accounts, affected by transition difficulties, caused some consternation with the disclosure of a trading loss and a cut in the distribution to 10 per cent. For the year ended last March, however, profits have been restored to over the £50,000 mark. In the interval the shares have been down to 47s. Despite the recovery, the yield is still 5 per cent.

Revo Electric

This company's final distribution followed closely on the Aron announcement and were related to the same period. The Revo results caused a rise in the 10s. shares from 55s. to 60s. 6d.; later the price reacted to 59s. With an increase in the final dividend from 10 to 12½ per cent and in the bonus from 5 to 10 per cent, the total of 27½ per cent compares with last year's 20 per cent, and improves on an already fine dividend record. On the new basis, the yield works out to £4 15s. per cent, allowing about 1s. 3d. net dividend included in the price of the shares. The company is among those singled out in the market as likely to be amongst conspicuous beneficiaries from E.P.T. relief. Last year's accounts showed that total taxation took nearly £200,000 from a trading profit of £279,000.

Price Movements

Apart from one or two good features noted elsewhere in this column, the prices of electrical equipment shares are generally lower where changed. A.E.I. have reacted 1s. to 92s., and Automatic Telephones have lost a further half-crown to 67s. 6d. Electric Constructions, at 62s. 6d. ex dividend, English Electrics, at 62s., Lancashire Dynamos, at 6, and Reyrolles at 82s. 6d., have all yielded ground. The radio group is also easier, but among engineering shares Associated British Engineering have recovered 2s. 6d. to 50s. and Babcocks are better at 77s. 3d. A few electricity supply shares have been marked down 6d. Central Electricity Board issues have followed the downward slant of the gilt-edged market, and Home Railway senior stocks pursue a similar course. Thomas Tilling at 66s. 6d. are 6d. easier.

Market Reactions

Engineering and Lighting shares have fallen to 2s. on the passing of the half-yearly preference dividend. Veritys 5s. shares, now 7s. 6d., have recovered part of the drop to 5s. which followed the reduction of the dividend from 7½ to 2½ per cent. British Electric Resistance 2s. shares have fallen to 3s. 9d. since the announcement that it will again be impossible to recommend a dividend for the year just ended. Peto Scotts, at 7s., are 6d. lower; the dividend is unchanged at 25 per cent. E. K. Cole, at 23s. 6d., were not influenced by the maintenance of the interim payment at 8 per cent.

Arrangements are reported to be in progress for the issue of £1 million 3¼ per cent redeemable debentures by Ericsson Telephones. At the last annual meeting, reference was made to the question of converting bank loans into a more permanent form. No fresh developments have occurred in the Cable group.

RECENT INTRODUCTIONS

Notes on New Electrical and Allied Products

Clock Regulator

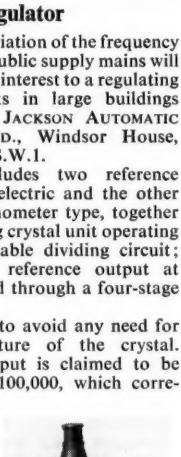
THE probability that variation of the frequency of a.c. derived from public supply mains will persist for a few years adds interest to a regulating outfit for multiple clocks in large buildings which is available from JACKSON AUTOMATIC ELECTRIC CONTROLS, LTD., Windsor House, Victoria Street, London, S.W.1.

The combination includes two reference clocks, one synchronous electric and the other of the spring driven chronometer type, together with a frequency regulating crystal unit operating at 100 kc/s through a stable dividing circuit; this furnishes a 50 c/s reference output at 200-250 V, which is passed through a four-stage mains-energized amplifier.

The circuit is arranged to avoid any need for controlling the temperature of the crystal. The accuracy of the output is claimed to be better than one part in 100,000, which corresponds to an error of one second in 27·8 hours. The outfit is obtainable in 15 and 30 W sizes for regulating groups of ten and twenty slave clock dials.

Rubber Handlamp

A waterproof and shockproof handlamp has been introduced by ROWLANDS ELECTRICAL ACCESSORIES, LTD., Hockley Hill, Birmingham, 18. The handle portion is moulded in one piece of tough rubber of a quality that is not easily attacked by acid or oil. The lamp bulb and its holder are enclosed within a screw-neck well-glass, British pressed of heavy quality, which is in turn protected by a galvanized iron-wire guard cage.



Rubber handle "Real" inspection lamp

Rosin Flux

To avoid some of the difficulties encountered when rosin in its pure state is used in pre-tinning processes and dip soldering, "Telecene" flux has been introduced by H. J. ENTHOVEN & SONS, LTD., 230, Thornton Road, West Croydon, Surrey. This clear fluid consists of rosin dissolved in spirit with the addition of an activating agent that is soluble in rosin (not in suspension) so the fluid does not need frequent stirring and will not deposit its essential constituent.

It is claimed that the flux has good "wetting" properties and spreads rapidly, minimizes undesirable build-up on the surfaces and prevents excess of pre-tinning metal within slots, hooks and shoulders of soldering tags. It is particularly suitable for telephone exchange equipment; the residue is non-corrosive, solidifies to a semi-transparent film of insulating value, is non-hygroscopic and unaffected by tropical conditions. Heating the activated rosin does not produce deleterious fumes or unpleasant odour.

Infra-red Moisture Tester

An infra-red moisture tester for sampling purposes is made by BEDFORD PRODUCTS & LIGHT ENGINEERING CO., LTD., Otterpool Way, Watford By-pass, Herts, and sold exclusively by TOWNSON & MERCER, LTD., 390, Sydenham Road, Croydon, Surrey. The instrument consists of a sensitive air-damped balance, the beam having a counterweight at one end and a vertical rod at the other that passes upward through the casing for supporting a single weighing pan, which is enclosed in a separate aluminium-walled chamber on top of the cabinet.

A 300-W infra-red lamp with a rhodium-plated reflector concentrates its rays on to the weighing pan, so drying the sample of material to be tested. The moisture content (by loss of weight) is indicated by a pointer on a graduated scale that can be read to 0·1 per cent. The base of the cabinet contains a step-down transformer with two sets of tappings led out to the front panel for adjustment of the input voltage to the lamp to suit the material being tested.

Domestic Appliances

Two more household appliances have been added to the range made by H. FISHER, LTD., Glodwick Road, Oldham, Lancs. One of them is a bread toaster large enough to accommodate two slices from a 2-lb loaf. Depression of a spring lever at one side turns the bread and, on release, closes the toaster. The finish is black and chromium plate.

The other item is a clothes drying cabinet 20 by 20 by 74 in. high and weighing 72 lb, constructed of aluminium and finished in cream and green enamel. A foot-switch and pilot lamp are fitted in the base, which encloses the 1-kW heating elements beneath a protective metal tray through which three hot-air distributors project upward. Outlet louvres are provided at the top of the cabinet, which is fitted with removable racks; the lower rack can be hinged back to one side and secured by clips.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1s. each) may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1943

METROPOLITAN-Vickers Electrical Co., Ltd., and J. D. Simons.—" Electric control systems employing limit switches for electric and other motors." 18713. November 10th, 1943. (590060.)

1944

Sperry Gyroscope Co., Inc.—" Apparatus for gang tuning hollow resonators in high-frequency electron discharge tube structures." 2437. February 15th, 1943. (Addition to 554574.) (590168.)

General Electric Co., Ltd., R. G. Jakeman and H. Nielsen.—" Regulating means for induction motors." 6156. April 3rd, 1944. (590171.)

L. Urmenyi.—" High sensitivity electromagnetic relay." 15164. August 9th, 1944. (590179.)

D. G. Reid.—" Multi-channel high-frequency signalling systems." 15581. August 15th, 1944. (590066.)

D. G. Reid and P. J. Nowacki.—" Multi-channel high-frequency signalling systems." 15582. August 15th, 1944. (590067.)

British Mechanical Productions, Ltd., and S. T. Deakin.—" Thermionic valveholders." 16100. August 23rd, 1944. (590069.)

G. Morton.—" Dielectric materials." 17440. September 13th, 1944. (590183.)

Akt.-Ges. Brown Boveri & Cie.—" Anode arrangement for pumpless rectifiers." 17521. October 19th, 1943. (590184.)

Lyteze Firelighter Co., Ltd., and W. T. Warren, sen.—"Electric sealing irons." 19010. October 4th, 1944. (590071.)

1945

Patelhold Patentverwertungs- & Elektro-Holding Akt.-Ges.—" Electrical impedance-transforming networks." 516. October 16th, 1943. (590203.)

B. E. D. Kilburn (Sulzer Frères Soc. Anon.).—" Gas turbine plants." 1010. January 12th, 1945. (590208.)

Marconi's Wireless Telegraph Co., Ltd.—" Radio receivers operating with diversity reception." 1121. January 14th, 1944. (590209.)

Marconi's Wireless Telegraph Co., Ltd., K. R. Sturley and B. Easter.—" Frequency discriminator or circuits." 1945. January 24th, 1945. (Addition to 561954.) (590210.)

G. S. Saylor.—" Selector system for printing telegraph apparatus." 3102. September 2nd, 1944. (590213.)

E. W. Anderson and T. J. McDermott.—" Pulse generators." 4027. February 16th, 1945. (590215.)

Standard Telephones & Cables, Ltd.—" Multiple connections for the terminals of electrical apparatus." 5244. March 13th, 1944. (590086.)

Maschinenfabrik Oerlikon.—" Alarm relay having visual indication." 5259. March 9th, 1944. (590228.)

S. Farnish.—" Closed circuit fire alarm systems." 6234. March 13th, 1945. (590087.)

Igranic Electric Co., Ltd.—" Controllers for electric motor driven travelling machines." 6544. March 18th, 1944. (590088.)

Standard Telephones & Cables, Ltd.—" Electric pulse width measuring system." 8486. March 26th, 1943. (590242.)

Standard Telephones & Cables, Ltd., and D. L. A. Driver.—" Manufacture of selenium elements such as rectifiers." 8639. April 7th, 1945. (590243.)

British Thomson-Houston Co., Ltd., J. H. Walker and G. E. Middleton.—" Dynamo-electric machines." 9109. April 12th, 1945. (590101.)

British Thomson-Houston Co., Ltd.—" Electric regulating switches." 9110. April 15th, 1944. (590102.)

Compagnie de Produits Chimiques et Electrometallurgiques Alais, Froges and Camargue.—" Method of re-adjusting the supporting and current-supplying metal rods of continuous self-braking electrodes." 9129. January 18th, 1944. (590250.)

A. H. Annell.—" Light fitting for tubular electric lamps, and particularly for luminous discharge tubes." 9441. April 27th, 1944. (Cognate application 9442/45.) (590150.)

Elco, Ltd., and S. Zipkin.—" Time switch." 9164. April 25th, 1944. (590117.)

T. A. Craven.—" Reception of wireless transmissions." 9206. April 13th, 1945. (590122.)

W. T. Nichols.—" Electrical contact devices." 9290. April 13th, 1945. (590132.)

English Electric Co., Ltd., General Electric Co., Ltd., J. H. Barnard and C. A. Wilson.—" Electric fuse holders." 9305. April 13th, 1945. (590136.)

F. W. R. Bird.—" Inertia switches." 9373. April 14th, 1945. (590144.)

Standard Telephones & Cables, Ltd., and R. F. Cleaver.—" Deflection arrangements for oscillographs." 9384. April 14th, 1945. (590260.)

Standard Telephones & Cables, Ltd., and R. F. Cleaver.—" Arrangements for repeating oscillograph indications at a distance." 9385. April 14th, 1945. (590261.)

British Thomson-Houston Co., Ltd., and L. Griffiths.—" Dynamo-electric machine for automotive vehicles." 9435. April 16th, 1945. (590149.)

J. F. Levers, P. Bowles and R. V. Patchett.—" Electrical resistance elements." 9150. April 12th, 1945. (590290.)

Mathieson Alkali Works.—" Electrolytic cells having mercury cathodes." 9457. May 4th, 1944. (590151.)

R. Austin.—" Electrode holder for use in electric welding." 9550. April 17th, 1945. (590158.)

Lyteze Firelighter Co., Ltd., and W. T. Warren, sen.—" Handles for electric hand tools." 25910. October 4th, 1944. (Divided out of 590071.) (590072.)

British Thomson-Houston Co., Ltd.—" Centrifugal type compressors." 96345. April 21st, 1944. (5903001.)

Western Electric Co., Inc.—" Mode filters for electromagnetic waves." 9636. April 28th, 1944. (590302.)

British Thomson-Houston Co., Ltd., L. Griffiths and S. H. Franklin.—" Generator and ignition unit assembly for automotive vehicles." 9730. April 18th, 1945. (590313.)

W. E. Smith, V. R. W. Bohener and W. Frost.—" Electric heating devices." 9733. April 18th, 1945. (590314.)

C. D. P. Smallpeice.—" Control switch for an electromagnetic starter relay or contactor." 9932. April 20th, 1945. (590318.)

Telegraph Condenser Co., Ltd., P. A. Sporing and C. P. Johnson.—" Means for unwinding rolls of material." 19873. August 2nd, 1945. (590108.)

Ferranti, Ltd., and V. Z. de Ferranti.—" Magnetic suspension for electricity meter spindles." 9557. April 17th, 1945. (590292.)

St. Helens Jubilee

Lord Citrine on the Industry's Future

THE desirability that the transition period until the transfer of the electricity supply industry to complete public ownership should be as short as possible was mentioned by Lord Citrine, P.C., K.B.E. (who is to be chairman of the proposed British Electricity Authority), at the dinner held on July 21st to celebrate the jubilee anniversary of the St. Helens electricity undertaking. The guests included representatives of neighbouring municipal authorities and local power consumers, Mr. H. Nimmo (Electricity Commission) and about twenty employees with over thirty years' service and twenty-four retired employees.

Lord Citrine briefly surveyed the growth of the St. Helens undertaking, remarking that although it was an industrial district there were 168 farms supplied with electricity. Concerning the future, Lord Citrine said if there was one industry which was prepared for the changes now taking place, it was the electricity industry, two-thirds of which was already publicly owned. The nationalized industries must establish their efficiency so as to be at least equal and superior to those which preceded them. Ultimately the test would be found in the measure of service they could render to the public. The British public were ready to give a fair trial to any measure of reconstruction which the Government might embark upon, but this could not be regarded as a blank cheque on futurity. He believed there were great advantages in the co-ordination of the electricity supply industry which should enable the new British Electricity Authority to establish its superiority and it was imperative, in order to do this, to secure a close measure of contact with the personnel of the industry and with local authorities. The Area Boards and the Consultative Councils must reflect the civic spirit and the pride in the undertakings which had formerly been the mainspring of the municipal undertakings. He was convinced that the electricity industry had a great future.

Ald. E. Burrows, J.P. (chairman St. Helens Electricity Committee) said the kWh sold had increased from 35,700 at an average price of over 6d. per kWh in the first year, to the present figure of 146 millions at an average of less than 1d. per kWh. He hoped that in the future they would be free to give consumers the same high standard of service that it had been their aim to give in the past. As a memento of the occasion he presented to Lord Citrine a wall mirror made in the works visited during the afternoon.

Mr. J. Eccles, B.Sc., M.I.E.E. (city electrical engineer, Liverpool), hoped that under the new electricity authority engineers would be allowed to exercise the same initiative as the engineers of the past.

Mr. J. Meikle, M.I.E.E. (Pilkington Bros., Ltd., St. Helens) said that in the years ahead the welfare of this country would depend on how it gained and held its export markets and in this respect an uninterrupted supply of cheap electricity would play a big part. They wanted the highest possible standard of living to be provided for everyone associated with the industry and everyone to give the highest possible return.

During the afternoon parties visited the works of some of the biggest industrial users of electricity in the borough. Lord Citrine went to the plate-glass works of Pilkington Bros., Ltd., where in 1908 he secured employment as an electrician.

The electrical engineer of the St. Helens undertaking is Mr. P. Bregazzi, M.I.E.E., A.M.I.Mech.E.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Birkenhead.—September 15th. Electricity Department. One 80-kW mercury arc rectifier equipment. (See this issue.)

Dover.—August 25th. Corporation. Mercury discharge street lighting equipment. (See this issue.)

Farnworth. — August 16th. Electricity Department. Meters and 1,000-kVA transformer. (July 25th.)

Halifax.—September 1st. Electricity Department. Transformers. (See this issue.)

Iraq.—The Crown Agents for the Colonies invite tenders on behalf of the Iraq Government for twelve Diesel-driven generating sets. (See this issue.)

Lincolnshire.—August 15th. County Education Department. Electric lighting installation at Bourne County School. (See this issue.)

Manchester.—August 27th. Waterworks Committee. Fifteen sets of electrically driven pumps. (July 25th.)

Middlesbrough.—August 25th. Tees Valley Water Board. Electrically driven centrifugal pumping plant in connection with Ormesby reservoir and pumping station. T. S. R. Winter, manager to the Water Board, Corporation Road.

Newport (Mon.).—August 12th. Corporation. Rewiring of the electrical installation in the central library and museum and art gallery. (July 25th.)

Skelton and Brotton.—August 18th. Electricity Department. Two 3-phase static transformers. (July 18th.)

Swanage.—August 4th. U.D.C. Electrical installation in twenty-six Council houses. (July 25th.)

Orders Placed

Middlesbrough. — Corporation. Accepted. Cable (£11,504).—Hackbridge Cable Co.

Stockton-on-Tees.—Electricity Committee. Recommended. Equipment for Oxbridge Lane substation and North Tees Trading Estate supply, respectively: H.v. switchgear (£1,529 and £2,352).—A. Reyrolle. L.v. switchgear (£315 and £333).—W. Lucy & Co. Transformers (£589 and £1,092).—C. A. Parsons.

Workington (Cumberland).—Electricity Committee. Accepted. 2,500-kVA transformers —English Electric.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Ayr.—Houses (50), Forehill Road, for the Scottish Special Housing Association, Ltd.; W. Govan & Sons, builders, 85, Main Street, Prestwick.

Barnsley.—Dining hall and kitchen, Council School, Mapplewell, for West Riding Education Committee; W. Barber, builder, 52, Northgate, Pontefract.

Bebington.—Houses (58), Brackenwood, for T.C.; R. J. Barton & Sons, Ltd., builders, Station Road, Ainsdale, Southport.

Bedlington.—Electric lighting, etc., to be installed in 86 U.D.C. houses; W. Hall, surveyor, U.D.C. offices.

Birkenhead.—Factory in Corporation Road; British-American Tobacco Co., Ltd., Westminster House, Millbank, London, S.W.1.

Brighton.—Factory at Moulsecomb Way and Westgate Road; De Cockson & Co., 31, Frederick Place.

Chesterton.—Houses (54), Coton, and housing scheme at Grantchester; R.D.C. surveyor, County Hall, Hobson Street, Cambridge.

Doncaster.—Kingfisher County School, Education Committee; Hemsworth Bros., builders, Ravenworth Road.

Eccles.—Extensions to Printing Works, Stronach & Co., Brighton Road; W. Brittain & Son, Francis Avenue.

Edmonton.—Rebuilding factory, Bridport Road, for Dunlop Rubber Co., Ltd., Fort Dunlop, Birmingham; J. W. Wilson, staff architect.

Exeter.—Nurses' sleeping quarters, dining room and kitchen accommodation, pathological department, engineers' workshop, electrical installation, wiring, etc., at the Royal Devon & Exeter Hospital (£40,000); clerk to the Board, Southernhay.

Falkirk.—Improvements at works (new offices, bath sprays, etc.) for Callendar Abbots Foundry, Ltd.; Mr. McIntosh, of Callendar Abbots.

New Roman Catholic school at Merchiston (£160,000) for Stirlingshire Education Committee; county architect, Stirling.

Flint.—Houses (30), Vern Estate, Bagillt; D. H. Davies, town clerk, Town Hall.

Grangemouth.—Factory buildings, plant and petroleum products depot (£47,585) for Scottish Oils, Ltd.; the manager, 53, Bothwell Street, Glasgow, C.2.

Grimsby.—Houses (72), Little Coates Road (£95,370), for T.C.; J. Laing & Son, Ltd., contractors, Mill Hill, London, N.W.7.

Hazel Grove.—Houses (36), Hazel Grove and Bramhall U.D.C.; W. H. Matthews, Ltd., Newport Road, Manchester, 21.

Holyhead.—Parish Hall, Trearddur Bay, for Committee; T. E. Thomas, architect, Lys Tririon.

Hornsea.—Dining hall and kitchen, Council School, for East Riding Education Committee; Houlton & Grant, builders, 71, Beverley Road, Hull.

Ilford.—Extensions to Maternity Home (£38,000), for Town Council; L. E. J. Reynolds, Town Hall.

Keighley.—Extensions, Victory Works, Dalton Lane; G. A. Rix, Ltd.

Kidderminster.—Erection of factory; Robinson Bros., Ltd., chemical manufacturers, Ryders Green, West Bromwich.

Kirbymoorside (North Riding). — County primary school; county architect, County Hall, Northallerton.

Ledbury.—Factory for Alex. Robb & Co., Ltd.; Webb & Gray, architects, 200, High Street, Dudley.

Leighton Buzzard.—Corset factory for Gossard, Ltd.; H. A. Rolls, 15, Bridge Street.

Lincoln.—Secondary school, Scunthorpe (450 places); A. R. Clark, county architect, County Offices, Newland, Lincoln.

Liverpool.—Dairy, Kenyon Lane, Maghull, Morton's Dairies, Ltd.; W. A. Gale, Ltd., builders, Linacre Lane, Bootle.

Cubicles, tropical diseases ward, etc., at Smithdown Road Hospital; city engineer, Municipal Buildings, Dale Street.

Llandudno.—Houses, flats, bungalows and shops, Conway Road scheme; U.D.C. surveyor.

Macclesfield.—Houses (98) on six sites; J. H. Walters, R.D.C. architect, 19, Moody Street, Congleton, Cheshire.

Manchester.—Public abattoirs, Queens Road and Cheetham Hill Road, for T.C. (£1,500,000); L. C. Howitt, city architect, Town Hall.

Primary school and nursery school for Education Committee; Moston Brick & Building Co., Ltd., Moston.

Newcastle-on-Tyne.—Extensions & alterations to the Princess Mary Maternity Hospital, North Road; W. Curtis Green, Son & Lloyd, 5, Pickering Place, St. James Street, London, S.W.1.

Prefabricated steel houses (100), Longbenton, for City Council; Cussins (Contractors), Ltd., Jesmond.

Reinstatement of Heaton Grammar School; F. Harvey, Education Offices.

Newport.—Dining hall and kitchen, C.E. School, for Shropshire Education Committee; Kent & Sussex (Contractors), Ltd., 270, Corporation Road. Birmingham.

North Shields.—Bakery in Waterville Road for the Puroh Bakeries, Ltd., Sutton Street, Newcastle; Gray & Kinghorn, Camden Street.

Norwich.—Factory on thirty-five-acre site, Hall Road; Norfolk Film Base, Ltd., 16, St. Martin's le Grand, London, E.C.1.

Redbourn.—New factory on Silkmeadow site for Extracts, Ltd., 2, Curtain Road, E.C.2; Fuller, Hall & Foulsham, 212, High Holborn, W.C.1.

Rochdale.—Houses (140) and 16 bungalows, for T.C.; A. Cassel & Sons, Ltd., 1, Teneriffe Street, Salford, 7.

Rotherham.—Primary school, Broom Valley; director of education.

Rugby.—Extensions, Hospital of St. Cross, for Board of Governors; W. T. Loveday, architect, 2a, Lawrence Sheriffe Street.

Ryedale (North Riding).—Secondary school for North Riding Education Committee; county architect, County Hall, Northallerton.

Shaftesbury.—Brick houses (62), Lodbourne Farm, Gillingham, Dorset; R. M. Westgate, R.D.C. architect, National Provincial Bank Chambers, The Commons.

Stoke-on-Trent.—New works at industrial area; Richard Crittall & Co., Ltd., 152, Gt. Portland Street, London, W.1.

Wakefield.—Extension to Eastmoor housing scheme (dwellings for 3,000 persons); borough engineer.

Wednesfield.—Junior and infants' school, Colman Avenue, Staffs Education Committee; A. C. H. Stillman, county education architect, County Offices, Stafford.

West Bromwich.—Primary school, Harvills Hawthorn; H. Schofield, borough engineer, Town Hall.

Westbury (Wilts).—Cement works, White Horse (£800,000); Associated Portland Cement Manufacturers, Ltd., Portland House, Tothill Street, London, S.W.1.

Export Inquiries

WE have received the undermentioned inquiries from firms and individuals overseas who wish to secure agencies for British electrical equipment and appliances or to import them into their territories. We shall be glad to pass on to them replies received from readers, which should be addressed to the Editors, quoting the number given in parentheses. We cannot vouch for the standing of inquirers and manufacturers replying to them will no doubt require the usual references :—

Adelaide, South Australia.—Firm, accustomed to sales and service of electric clothes-washing machines since 1924, anxious to undertake distribution of British-made models, both spin-dry and wringer types; also domestic ironing machine. (X.187.)